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ORIGINAL ARTICLES

WHAT ARE THE REQUIREMENTS OF ORTHODONTIC DIAGNOSIS?*

L. M. WAUGH, D.D.S., F.A.C.D., NEW YORK, N. Y.

WHEN the invitation came to me to talk on the requirements of orthodontic diagnosis, my first reaction was naturally to say that I could not address you on this subject because I preferred to talk to an audience about something of which I had some knowledge. The genial chairman of the Board of Censors was so far away and wrote me such enticing letters, that I finally, after letting the thing go for a time, decided I was rather remiss; and so, in a rather optimistic moment, I telegraphed saying I would accept.

In getting my material together and thinking of something by way of an expression as an introduction which might be adequate, I thought of the witty little jingle which at first was selected as a matter of humor but became rather serious and perhaps a matter of pathos a little bit later. The jingle runs something like this:

Look at the happy moron,
He doesn't give a damn.

And as I worked further, the third line—

I wish I were a moron.

impressed itself and toward the end I found the fourth line to be just right.

My God! Perhaps I am.

That is the attitude in which I approach you: Perhaps a happy moron for one reason, in that I accepted; for another reason, that I am addressing you on a topic of which I perhaps fairly happily know almost nothing in my groping.

What are the requirements for an orthodontic diagnosis?

In surgery and pathology, we were taught that the determining and removing of the cause is the first principle of any treatment. When we use the word

*Section of symposium presented before the American Society of Orthodontists, Toronto, Canada, May, 1932.

"cause," we immediately begin to think of etiology, because etiology is the study of the cause of disease.

Diagnosis is defined as the study of the symptoms, or as the determining of disease by a comparison of symptoms. Diagnosis in pathology is divided usually into three classes: direct, differential, and diagnosis by exclusion. A direct diagnosis is one in which one or more of the symptoms are positive. A differential diagnosis is the distinguishing of diseases one from the other by a comparison of symptoms. Diagnosis by exclusion is the determining of a condition of disease by the exclusion of similar diseases.

If the term "diagnosis" applies to the work that we are doing in orthodontia, then I feel that the second designation, "differential diagnosis," is the one that we must usually apply, because we have very little direct diagnosis, as I see it. We have some diagnosis by exclusion, but most of it is differential diagnosis, or the determining of the condition by comparing the symptoms.

A symposium is defined as "several brief opinions or essays as given by different speakers or writers on the same subject." Because of this I have chosen, being the first in the group of three, to give a sort of general, practical consideration of the subject strictly from the standpoint of the clinician.

My presentation has been planned along the line that I follow in studying a new case, in outlining my procedure in treatment, and also that type of procedure and outline which we use with our graduates in dentistry who are preparing in a year's course for specialization in orthodontia.

In my mind it is a question whether the term "diagnosis" as it is applied in pathology has that specific application in orthodontia. In pathology they are trying to determine the cause of disease. Frequently, it is a single cause, as a single direct specific infection. In pathology they are finding a symptom which they may directly treat over a short period for the purpose of overcoming an acute condition more or less rapid in termination. Either it will grow very much worse and they will have a very sick patient, or the symptoms will disappear and the patient will get well. In pathology they are treating a state of disease. In orthodontia we are not treating disease; we are treating an abnormal condition, which while abnormal is only rarely pathologic and extends over a period of months and often years.

I think the application of the term "diagnosis" needs to be defined rather nicely in this connection. Malocclusion, not disease, yet abnormal, is in its incipency, in other words, in the period of our treatment, a very strong predisposing factor to disease which becomes progressive as the condition continues and as the patient grows older, but as we treat the child, we are not diagnosing and treating a disease. So I feel that much of what we study under the general term "diagnosis" is really more specifically a gaining of information as to the condition for the purpose of making a classification of the malocclusion that we are to treat. I think the term "diagnosis" has a less direct application to orthodontia than to pathology, and has a closer relationship to classification than to real weighing of symptoms.

I am going to have the temerity to introduce a little addition to Angle's classification for the purpose of putting into words that which has gone through our minds during the years, and which it has been difficult for me to pass over to the

Refer this sentence to bracket page 353 -

beginner in the study of orthodontia, be he a graduate in dentistry or be he an undergraduate student.

Angle's classification gives us Class I, Class II, and Class III. In this classification, Classes II and III are subdivided. Class I has no subdivision. It has been difficult for me to explain to students that condition in Class I in which the maxillary molars on one or both sides have shifted to the mesial. It is difficult for me to get over to the beginner the difference between that state which is strictly a Class I, and a true distocclusion in which the whole mandible is distal to normal.

Dr. Angle, when he gave us his classification, of course worked on the theory that the maxillary permanent first molar was never in a mesial position to the normal. Of course, all of us know that in later years, after the seventh edition of his book was published, he changed his mind. So with my classes, and for your consideration, I am going to suggest that in Class I we have this elaboration: in Class I the dental arches, teeth, and jaws are normal in their mesiodistal relations. This is characterized by the normal positions of the permanent maxillary first molars at least in their mesiodistal relations, although one or more may be in buccal or lingual occlusion.

The Angle classification does not provide a division and subdivision in Class I. To the Angle classification I have added these, because without them various conditions are difficult for the beginner to comprehend, and are therefore puzzling in diagnosis and confusing in treatment. The additions which I suggest are: Class I division, and Class I subdivision. In Class I division, the mandible is in proper anteroposterior relation to the cranium, with the maxillary permanent first molars of both sides shifted to the mesial for more than one-half the width of a cusp. This condition may be made possible in any one of three ways: (a) by caries of the proximal surfaces of deciduous molars and canines; (b) by premature loss of deciduous teeth without the placement of a space retainer, and (c) by the absence of one or more follicles for a maxillary premolar or a permanent canine.

Class I subdivision is the term applied when only one side is so affected, the other being in normal mesiodistal relationship.

I find that my students grasp the idea and are much less liable to classify a Class I, where the maxillary molars have shifted to the mesial, as Class I than to classify them erroneously as Class II. I presume all of us have seen cases in the hands of the less experienced operator where this condition was being treated perhaps over a period of years as a Class II case.

Dr. Angle made his classification and outlined his treatment, which cannot be separated from treatment and classification, if you please, on the thesis that heredity had practically no influence upon the size and the form to which the dental arches might be grown. His contention was that as the result of mild, mechanical pressure he might grow a jaw of any size or any shape that it might be the decision of the orthodontist to produce. He, too, with the rest of orthodontists, I am sure, must have found the fallacy of this. In speaking of this, I am not criticizing. What is being said today may seem ridiculous thirty years from now, and I hope that is true of a lot I am saying, because we must make progress. In the diagnosis and classification, in that guidance for treatment which I follow, that side of the problem is entirely in the discard.

I have a little chart that I wish to show, which was suggested by a chart that Dr. Lodholz of the University of Pennsylvania uses in his teaching of physiology, a modification of which was shown by Dr. Harry Wright in a clinic which he gave at Nashville, and which I have had drawn out in its application to the development of the denture in relationship to heredity, and acquired tendencies. I shall go over what seems to me the only sane and rational viewpoint with reference to heredity in its influence upon the form and the size of the dental arch.

The fertilized ovum must contain all those factors which heredity gives to the being about to be formed. After nine months in utero, the human infant is born. As orthodontists, only in a very general way are we ever called upon to direct during the period of gestation. It belongs more particularly to the pediatrician.

We have a union of the male and female pronucleus, each one exerting an influence which at the time of fertilization, at the time of birth, and for sixteen or seventeen years after birth plays and interplays in a manner which it is impossible for anyone to determine or to control fully.

From the fertilized ovum shown in the chart to the completed denture, is determined that pattern of occlusion, that is preordained. If nothing by way of nourishment or illness, or any other extraneous influence is brought to bear, then from fertilization to the completed denture is a predetermined picture. However, there are so many influences varying with each little life under all sorts of conditions, that what is preordained at fertilization with reference to the finished individual normal in occlusion practically never occurs. Nourishment, illness, trauma, and all the groups of things that play a part have their influence, this group comprising the "acquired" influences.

As I see it, it is our effort as orthodontists to apply our differential diagnosis from the first time we see the prospective little patient until the time that the dentition is complete, which sometimes includes the period of eruption of the third molar. We must be constantly indulging in an analytical differential diagnosis of whether the dominant or recessive characteristics as determined in the fertilized ovum are at that period playing a part. We must decide what influences of illness or nourishment or lack of exercise or trauma may enter the picture and cause a detour from this straight highway predetermined by heredity to the finished occlusion. When a detour from that highway occurs, it is our duty, in differential diagnosis, to determine early the nature and extent of that detour and simply turn the traffic of development back onto the direct highway.

To that extent I like the term "diagnosis" as applied to orthodontia, but I see the term quite different from its usual application, which is confused with the classification of malocclusion.

T. Wingate Todd, in his studies, quite surprised us two years ago at Nashville when he said that the period of most rapid horizontal development of the jaws occurs from the twenty-first day after birth to the seventh month after birth, and this has been included in this chart. From the twenty-first day after birth to the seventh month after birth is the period of most rapid horizontal development of the dental arches. Then we had a period of comparatively slow horizontal development going up to the fourth year. From this age to the seventh year is the second most rapid growth period. After that a period of comparative slowness in

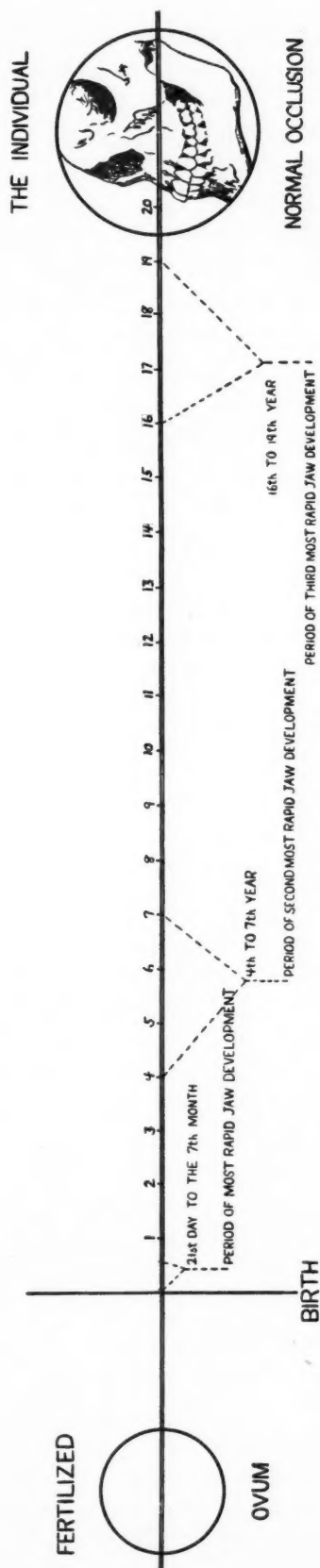


Fig. 1.—Adapted by the author to the development of the jaws and individual normal occlusion. The suggestion came from Harry B. Wright who obtained the idea from Prof. Ludholz, University of Pennsylvania.
The three periods of most rapid horizontal jaw development are after T. Wingate Todd, Western Reserve University. (Drawing and photography by Art Division, Columbia University, Dental School.)

development extends to the sixteenth year, and the third most rapid period of horizontal jaw development takes place from the sixteenth to the nineteenth year. Periods of vertical development intervene.

It seems to me that our differential diagnosis must be based on added knowledge as to the developmental cycles that occur in the development of the growing child under our care. We know that within the physiologic range—and it varies quite a little—certain things in the development of the little being must occur with reasonable regularity or a state of abnormality exists. For example, take the changing of the voice of the boy at a certain age. There is quite a range, but if it is much beyond that range, then one must look for some cause of the disturbance.

That same application might be elaborated, but it seems to me a similar viewpoint should guide us in our decision as to just what and just when the orthodontist should step in with his active treatment and with his periods of so-called rests in treatment. For example, I am not quite sure whether I believe we should be most active with our physical therapy in the period when nature naturally grows the jaw fastest, or whether we should let nature grow the jaw as much as she will and then step in and help when she is in the period of quiescent development. I have not quite decided. I do not think it is very serious if we do not get it quite right. In other words, I do not believe we have to hit the nail on the head at the psychological moment when the development takes place, because the range of vitality spreads, very fortunately, over so broad a period that unless we let it go way beyond that physiologic range no harm results as a rule.

Therefore, the diagnosis, which it seems to me I see, is dependent more upon our correct knowledge of developmental changes that occur just naturally in life. We must observe those, and when they do not occur properly, only then should we step in to help. We should step in and help at the period when certain developmental changes take place in the average healthy child when natural development is too much retarded.

For example, I believe nature intended that the jaws should be large enough to receive the teeth in the proper curve of the arch just prior to the time when they erupt. By so doing, the primary alveolar process is built where nature intended it should be. As the root of the tooth develops, very little change need take place, whereas, if we permit teeth to come in hoping that the jaw may grow sufficiently large at a later time to let them align themselves up after they are malposed, then we must cause a resorption at least in part of the primary alveolus with the building of a secondary alveolus. While I cannot see but that through the years a secondary alveolus supports a tooth just as well and just as long as a primary alveolus, it seems reasonable for us to expect that nature intended the teeth should erupt in the proper positions. I believe we should see to it that the jaws are sufficiently large just prior to the period of eruption of the teeth to let the permanent successors come into their proper positions with the least possible disturbance of primary bone structure.

In a study of a primitive race, a people of small stature, who in their primitive state have the largest jaws and best teeth of any race known, the jaws of the children are large enough so that the permanent teeth may just naturally come into proper occlusion. The jaws are not small. The teeth do not erupt out of place.

Nature does not have to put them into proper position later; they just grow there first hand.

In our diagnosis I think we need to know a great deal more than I have known until quite recently, and of which I know only a very small beginning now, of what is the normal in the contiguous structures as for example, in the nasal area and in the area which we call the throat. Those tissues are closely contiguous. The same blood channels which carry the nourishment to these parts and the waste from them are the highways which take nourishment to the teeth and to the jaws, and it is not sensible to expect that we may have a retarded and stultified development in the nasal area, and half an inch away or less in the dental area not to have it influence growth in that part. So in the throat I think we as orthodontists should have a very clear picture in our minds of what is normal at a given age for the throat and its structures, for the nose and its structures, and indeed for many of the structures of the body. Our differential diagnosis should teach us to base a knowledge of the abnormal upon a definite knowledge of what is normal at the given age in those structures in our patients. In fact, we should have that knowledge as it applies to the body as a whole.

I presume it has been the experience of many, as it has been mine, to find in the treatment of a little patient that everything has been going along very nicely, and all at once some serious illness affects the child. After that, the whole response to our efforts in treatment has been modified.

I have in mind three children in my practice who were afflicted with infantile paralysis some little time after I had begun treatment. I have learned to know quite definitely from experience in these three cases, and from a comparison of similar conditions with my confreres about me, that as soon as I have a little patient seriously affected with infantile paralysis, the response to my treatment is going to be quite different. The prognosis is going to be much less favorable, and so the differential prognosis for an orthodontic result is modified because of a modification of the whole bodily condition of that child. In two of these cases, I am now treating a younger brother in one and a younger sister in another, they were not affected; responses are going on just as they started.

In the differential diagnosis in our orthodontic treatment and in the outline of prognosis we must have that intelligence which will let us at least partially understand the modified condition which we may expect in the changed mental and physical condition of the little patient on whom we are working. A child with a serious trauma from a head injury, such as from a serious automobile accident, may give quite a different response to the same type of treatment which was bringing good progress before, and which only results in failure after. Differential diagnosis in orthodontia means that to me, and not the determination of the classification or the determination of the type of appliance I must make to treat this child. As the result of this, I am learning more and more to regard my orthodontic treatment as an observation of the whole physical development of the child as it affects the growth of the jaws and the positions of the teeth.

For example, if a little patient does not breathe through one nostril, I am learning to recognize that the normal air pressure in that nostril (which at sea level is fifteen pounds to the square inch) is less than that in the nostril through

which the child may breathe. I am learning to know that if the opening into the maxillary sinus is partially or wholly clogged on that side, which it usually is, I must not expect quite so good a growth of the maxillary sinus on that side. I am learning to know in my differential diagnosis that the child must be sent to a rhinologist who will do all that is possible as soon as he may to re-establish breathing in both nostrils, which is normal, knowing that a fifteen-pound pressure to the square inch is a greater pressure than can ever be exerted in the body by the proliferation of cells. I recognize the fact that in some of these little children where some process is affecting one side of the face, or where the shape of one eye is not quite the same as that of the other, there will be an unbalancing of the nourishment and waste removal on the two sides. I see that as the big thing in diagnosis in orthodontia.

I wish now to consider conditions of the throat. We might get into a long discussion as to whether adenoids have anything to do with malocclusions; whether pathologic tonsils have anything to do with malocclusion. The thought I hope to put over is that differential diagnosis in orthodontia implies a knowledge which will permit us to set apart those conditions which are interfering with the development of the child and with the reactionary development of that child specifically upon the orthodontic area.

In my differential diagnosis I keep constantly in mind the fact that at birth the face, the part below the anterior part of the brain cavity from the upper part of the eye down to the chin, occupies one-ninth of the area of the head, and without any orthodontic treatment; just by God's good graces as it was given to the child in the fecundated ovum, that face is going to grow so much faster than the rest of the head that at maturity, at seventeen or eighteen years of age, the face will occupy one-third the area of that head. That fact makes me very careful not to step in with any type of therapy, especially appliances, lest I interfere with the natural growth that the dental area has in every head. It makes me more cautious as the years go by. It makes me select that type of appliance which will not interfere with the direction of the natural growth of those tissues. I cannot measure, and I do not want an appliance there that is going to interfere with that natural unfolding, that downward and outward growth which nature will give the child without any appliances. When I have to use appliances, I want them in place for just as short a time as possible, and I want them to exert just as mild a pressure as it is possible to use, because I fear I may do harm.

I am learning to realize that the better my treatment in orthodontia, the less will I use mechanical means for bringing about growth and development of the jaws and the relationship of the teeth. If I can get nature to do it without mechanical assistance, I feel that I shall have done a great deal better service than if I have the child wearing appliances, as I used to have them do, for two, three, four, five—I guess I had better stop here—years almost continuously. Nature does not intend that. Nature does not have it anywhere else, and nature does not need it about the jaws.

We hear a great deal about food and diet as influences. I think of them a great deal in my orthodontic treatment. Not only do I think of and watch the metabolism, in other words the chemistry of diet, but what I do watch more and more every year is the mechanics of diet.

I have had the privilege of studying primitive peoples for a number of years,

*Only those with the
strong teeth and jaws
could have come through
environmental mixture —
the rest succumbed.*

and I have found that these people living in their nomadic bands, subsisting on native foods, frozen much of the year, dried meats, such as walrus, seal, whale, caribou, wild fowl, and fish, where they have little fuel with which to cook food, have strong teeth. The children chew almost from the very beginning of life, and I believe that these small people with these largest, strongest jaws, and best teeth have developed them largely because of the mechanical stimulation of the food they eat. It is the mechanical side of diet that interests me quite as much today from the standpoint of jaw development as does the chemistry of nutrition.

I have found that when those people get our soft foods that do not need chewing, even in one generation—I have casts to show them—the jaws become sufficiently smaller that the arches are crowded and the teeth become irregular. Nowhere in Labrador or arctic Alaska, where the Eskimo has taken on civilization around the missions, or where our government has so generously and kindly spread white man's clothing, food and living among the Eskimos, have they maintained their fine jaw size and their excellent teeth as they have in the wild, nomadic state. The jaws which I have shown, and which many of you perhaps have seen here and there, have great bulging areas of alveolar process over the apical half of the roots of the maxillary and mandibular teeth, and on the lingual sides of the mandibular teeth a ridge perhaps a fourth of an inch wide opposite the root ends, sometimes almost an eighth of an inch in thickness. This can be seen in the skulls in the National Museum in Washington. This, I think, is adventitious alveolar process because of rugged use in eating crude hard food, and in making their clothing, shoes, implements, etc.

So I know the mechanical side of the food that our patients eat is a very important factor in orthodontic treatment, and when I say orthodontic treatment, I mean treatment of the child from the time it comes to me for observation until I shall have finished with the appliances and the corrective treatment in that particular case. They are under my treatment, under my observation and care, and I try to measure the changes that occur, I am happiest when I use appliances least and still see that I am getting results.

Dr. Harry Neivert, a rhinologist in the Vanderbilt Clinic, who is giving a series of lectures to the graduates in orthodontia, made a statement which was new to me but which he had decided upon after years of thought and observation, and which I want to pass on to you because it gave me rather a broader appreciation of my duty to my patient. He said something like this: "Do you students in this class of orthodontia realize that no pediatrician, no physician, no child specialist ever has the opportunity—in fact, no worker in health service—of observing the development of the child so regularly and over so long a period of developmental life as you orthodontists do? You take upon yourselves the responsibility of observing that this development takes place normally. Have you given yourself sufficient training so that you at least know when things are not going to be sufficiently right so that you may refer your little patients to men practicing in collateral branches, such as the rhinologist, the pediatrician, the throat specialist, or the man who watches the ears, etc.? Do you know enough so that as orthodontists, with this best of all opportunity for the observation of these people, from a standpoint of differential diagnosis you can tell that this child needs help from some one who is practicing in a very closely related collateral branch of medicine?" That came

to the class within two months, and I am taking that as my newer opportunity and my newer obligation in diagnosis.

The research work that has been done by Sir Arthur Keith, the study by Brash, and by Sir Fred Collyer in the British Isles are most valuable. We need that sort of help. It gives us courage to feel that we are not on the wrong trend of reasoning when we believe that in developing the jaws we must depend upon bodily conditions to aid us. We are beginning to realize more and more that it is a problem of the whole bodily condition rather than just a local one. Then the fine work that has been done by our own fellow members, Milo Hellman, Clinton Howard and Samuel Lewis, and now Hally Broadbent who is working under T. Wingate Todd must be studied and applied. I look to the knowledge that those and other men bring us as the great light which shall guide us in the diagnosis in orthodontia more and more as we grasp it. We must learn the stages of normal development within physiologic range for each individual, and it is our duty to see that the proper change is brought about in the jaws at the proper period by our help.

In measuring the development, I am more and more impressed with the importance of craniometric, cephalometric and anthropometric measurements as a general guide in diagnosis. I think the craniometric method is perhaps the most applicable to our branch, and I include in this the contributions of Simon, Stanton, Schwartz, Hellman, Broadbent and others. I see in these a means of making a record of development; I see them as a means of studying the average changes that occur in great numbers of our patients at a fairly definite time. I do not see in them at all any possibility of predetermining an arch form. When you talk to me about that, then I must say to you: Are there two terms that are more positively, more diametrically opposed in all the gamut of science than biology and predetermination?

I have in mind two girls born ten minutes apart. They were brought to me at about nine years of age. I thought the younger one must be three or four years older than the other, and I pitied the poor little twin sister. I just thought nature had not been kind, and that when she apportioned the germinal material she did not make a fifty-fifty division.

Prior to puberty, the one child grew so fast that you would think she was three or four years older than her twin sister. She had developed early. She went along in school faster than the other sister. But after puberty the smaller one shot up so fast that in about eighteen months she had almost caught up with her larger, ten minutes younger sister, and when the girls had their full development they looked more like each other than they did like themselves.

We cannot tell just how fast a child is going to grow. We must just observe. We must not be too impatient to try to force growth because we may do harm.

We have all seen a mandible with perhaps only one or two follicles for permanent teeth, with the body of that mandible just as large as the mandible would have been had it accommodated sixteen teeth. There is a hereditary urge to do something there without our aid.

Maxwell Stevens of London, the general secretary of the Second International Orthodontic Congress, used a term in discussing his idea of what the orthodontist really does that I have used with my class this year, and that I like very much. He said, "I look at my orthodontic treatment as merely 'nudging nature'

when nature lags." So I want to find when nature lags, so that I may nudge nature just a little and wake her up so that growth will take place. I want to do that in such a way that by no possible chance do I introduce anything which will be a restraining or diverting influence on that growth. For that reason I am becoming more and more impressed with the physiologic soundness of a certain type of appliance which I think most every one now uses at least to some extent, and for which we are indebted to John V. Mershon.

In closing I wish to say that to me orthodontic diagnosis is entirely separate and distinct from classification. Orthodontic diagnosis is dependent upon our gaining a knowledge of the developmental change that is normal within the physiologic range for our individual patient at a particular time. After observing, if this does not occur, it is then our duty, always by the simplest means first and that may be only the chewing of food, to "nudge nature" to step out and catch up with what is the average normal for that individual at that time. As we approach the frontiers of our knowledge, no matter how sound clinically, we must look to research to show us the path for additional knowledge. And we look to such men as Hellman, Broadbent, Lewis, Howard, and other orthodontists with a research urge, in other than our own field as well as T. Wingate Todd, Sir Arthur Keith, and many others, to study the problem more fully and give us a better knowledge of what is the average normal in the entire bodily development as well as in the cranial and jaw development, so that this truer knowledge may be the newer and the sounder conception of our diagnosis in orthodontia.

WHAT ARE THE REQUIREMENTS OF ORTHODONTIC DIAGNOSIS?*

SAMUEL J. LEWIS, D.D.S., DETROIT, MICH.

WHEN I accepted the invitation to present a paper in a symposium on the requirements for orthodontic diagnosis, I was not sure that I fully understood the implications of the title. If I interpreted it literally and viewed orthodontia from a purely mechanistic point of view, I could state in one sentence the requirements for orthodontia diagnosis; namely, a set of orthodontic casts, with perhaps a set of roentgenograms and a profile and front view photograph thrown in, and a knowledge of the Angle classification. Or I could take a broader view of the subject and inquire directly into the principles underlying the problem of diagnosis. I chose to follow this second method, and my first step was to write to a few of my colleagues in order to get some idea of what orthodontic diagnosis meant to them. I received the following answers:

Dr. Lloyd S. Lourie: "Orthodontic diagnosis is considering the history, characteristics and extent of malocclusion with its associated abnormalities; and determining what corrections or improvements are possible and advisable."

Dr. Frank S. Cartwright: "Orthodontic diagnosis is the science or art of understanding the causes of malocclusion of the teeth and deformities of the face and jaws: it includes a definite knowledge of the possibilities or impossibilities for the successful correction of the malocclusion or deformity."

Dr. Ira A. Lehman: "Orthodontic diagnosis is the art of recognizing the presence of malocclusion from its signs or symptoms. It also includes the deciding as to its character, and cause, if possible, from any or all available information, and the decision arrived at."

Dr. Stanley A. MacKenzie: "Orthodontic diagnosis is the determining of the maximum efficiency for a dental apparatus; the determining of the physiologic processes through balance of the opposing teeth and their interdependent parts, the supporting structures. This must be correlated to produce an esthetic effect not only in the arrangement of the teeth themselves, but also in the harmonious relation of the features. In other words, maximum efficiency and esthetics must be considered in all their various aspects."

Dr. B. Holly Broadbent: "I have no definition. I find it necessary to have a set of casts made from plaster impressions, full mouth x-ray pictures of the teeth, a five-foot profile x-ray and profile and front view stereophotographs to scale. . . . Plaster records are frequently surveyed with Stanton's machine in the event that the size of the teeth or other features indicate it. I have found the five-foot profile x-ray picture very useful since 1921, along with the many other things that Angle and Todd have taught me that I apply to my diagnosis. Of late we have our Bolton standards which have made the large properly oriented films indispensable."

*Section of symposium presented before the American Society of Orthodontists, Toronto, Canada, May 18, 1932.

From these definitions it is apparent that while there is general agreement as to what constitutes the requirements for orthodontic diagnosis, the conception in each case is somewhat different from the classic definition of diagnosis as the art or act of recognizing the presence of disease from its signs and symptoms and deciding as to its character only. In the field of orthodontia there is a tendency to combine diagnosis, treatment, and prognosis under the one head. Perhaps this is the proper procedure in view of the limitations of our knowledge at present. Perhaps diagnosis should comprise at present an analysis of the occlusal condition of the teeth and correlated structures in order to determine the treatment required. It may, however, make for more or less confusion in the issue before us.

An inquiry into the requirements for diagnosis calls, first, for an appraisal of our present knowledge of the growth and development of the masticatory apparatus, the facts most significant to orthodontia, and needed data which are at present lacking or inadequate. It is of primary importance to determine what constitutes malocclusion of the teeth. Is malocclusion a phenomenon belonging to the sphere of pathology or to that of development? How are we to appraise the dental apparatus in order to determine not only what malocclusion is, but also what individual differences or variations must be taken into account in differentiating normal or typical growth changes from abnormal or atypical changes? In the light of our present knowledge can we say with assurance that in this case we have malocclusion, in that we have not? Do we know at present what factors act as obstacles to normal growth?

Dr. Edward H. Angle defined malocclusion as the perversion of the normal in the growth and development of the denture, the normal being based upon an ideal scheme represented by 100 per cent perfection. Dr. C. S. Case defines malocclusion as all dental and dentofacial malpositions which may be corrected by mechanical forces applied to the teeth. Dr. James D. McCoy defines it as a "deviation from the normal to such an extent as to interfere with the functions of the teeth," and Dr. A. LeRoy Johnson as "that condition of occlusion that interferes with the normal functional activities of the several structures that together make up the masticatory apparatus."

So definitions of malocclusion vary. All I have quoted are concerned with deviations from the normal, but none considers the problem in positive terms or gives us an example of malocclusion. McCoy approaches the goal when he considers function, and Johnson brings us nearer when he considers functional activity as including not only the process of mastication but also all the vital phenomena of the supporting tissues of the teeth and the interaction of these parts in the life activities of the whole organism. But all these definitions leave something to be desired; they give us no measure for determining what constitutes malocclusion.

It has been said that the law of occlusion is the basic principle upon which the science of dentistry is built. Hence, in our quest for a yardstick with which to measure occlusion and determine what constitutes malocclusion, we must look to such studies as Hellman made on variation in occlusion when he questioned the ideal scheme put forward by Dr. Angle. First of all, Hellman failed to find any justification for a theory of inclined plane occlusion. He did find that occlusion consists of a relation of functional factors, represented by cusps, fossae, ridges, grooves, surfaces, and embrasures. Further, he found that this type of occlusion

was justified on the basis of the evolution of the denture. He proved that the conception of 100 per cent perfection as representing the normal occlusion of the teeth was a myth. Hellman concluded that the type of occlusion in man is represented by a masticatory apparatus with an average of approximately 90 per cent perfection and a standard deviation of approximately 6 per cent. In other words, he gave us a measure by which we might determine the variations that often interfere with function to the extent of constituting an abnormal condition.

Hellman's findings are of great significance when we attempt to set up standards. However, as they are based upon the best 10 per cent in occlusion, as represented by the normal frequency curve, his conclusions concerning typical occlusion in man are open to question. If a similar study were made on a large number of cases, representing any and all types of occlusion, we should have a truer picture of typical occlusion in man. Until such a study is made, both of the deciduous and of the permanent denture, determining what constitutes malocclusion will be largely arbitrary; especially will this be so in cases representing individual variations which some orthodontists would classify as being within, others without, the normal range. Except in well-defined cases of malocclusion diagnosed on the basis of occlusal relations, diagnosis becomes a problem in which the individual orthodontist has little that is reliable to guide him. However, since function rather than structure is the ultimate criterion of the normal in medicine, we may with some reservations accept Hellman's findings as a basis for diagnosis, even though the data are incomplete. As further knowledge accumulates we must be prepared to modify our conclusions.

While occlusion is the basis for orthodontic diagnosis, we must go further. Hellman found that occlusion is functional in nature and is influenced by many of the factors controlling the growth and development of the whole body. Friel, carrying Hellman's work a step further, found that occlusion was not stable but obeyed the biologic law of continuous change. His findings point to the importance of tooth relations in the study of growth. Important among them was the finding that as wear takes place in the deciduous denture certain changes occur in occlusal relations.

Friel's description of the occlusion of the deciduous denture is quite at variance with the orthodox conception that in the molar series each tooth is antagonized by two teeth in the opposing jaw. He found that the first and second molars antagonize each other in unworn teeth and that the distal surfaces of the second molars end off flush. He thus accounted for the frequent appearance of an end-to-end occlusion of the first permanent molars upon eruption. However, as wear takes place the mandible shifts forward so that each tooth in the deciduous series is antagonized by two in the opposing jaw. This change accounts for the occlusal adjustment of the first permanent molars when the triangular ridge of the mesiobuccal cusp of the maxillary molar falls into the buccal groove of the mandibular molar. Friel thus brought to our attention the importance of observing growth changes in the adjustment of occlusion. This adjustment is an important consideration in diagnosing malocclusion.

Since Friel's study was made, we have had a number of children under observation at the Merrill-Palmer School in Detroit. A study of the impressions of the teeth and dental arches of these children, made yearly, substantiates Friel's

findings in the main. In our group two types of occlusion were found in the deciduous denture (Fig. 1). The first type corresponds to that of Friel, but the second



Fig. 1.—Two types of occlusion in the deciduous denture.



Fig. 2.—Type I occlusion showing lack of molar adjustment.

type corresponds to the type described in some of the textbooks. In the first type the first permanent molars do not assume their normal occlusal position unless

some occlusal adjustment occurs, and maladjustment results (Fig. 2). In the second type the molars assume their normal occlusal position without this adjustment unless they erupt in a badly rotated position (Fig. 3). This adjustment is sometimes unilateral, which may account for certain types of distocclusion (Fig. 4).

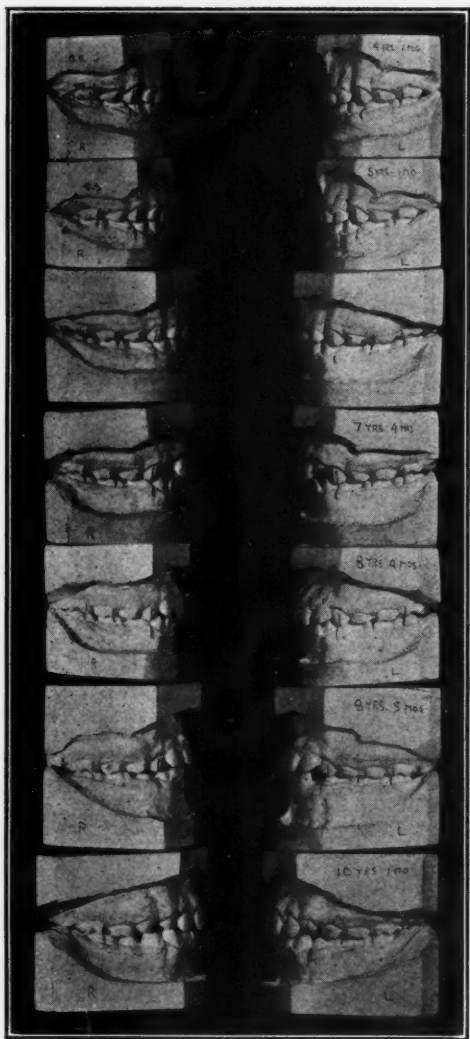


Fig. 3.



Fig. 4.

Fig. 3.—Type II occlusion showing normal locking of permanent molars without growth adjustment.

Fig. 4.—Unilateral molar adjustment.

This adjustment occurs early in some cases, in others as late as nine years of age (Fig. 5). It often happens that an apparently deep anterior overbite changes to an edge-to-edge bite or even an open-bite during this period of adjustment (Fig. 6).

These adjustments thus constitute an important consideration in orthodontic diagnosis, for what may appear to be a malocclusion at one stage of growth may represent only a phase in the development of the denture. Or if this adjustment does not take place normally, we may have the beginning of an aberration which will become worse as the denture develops. Such a case is represented in Fig. 7, where the first two models are in normal occlusion but the succeeding ones show the

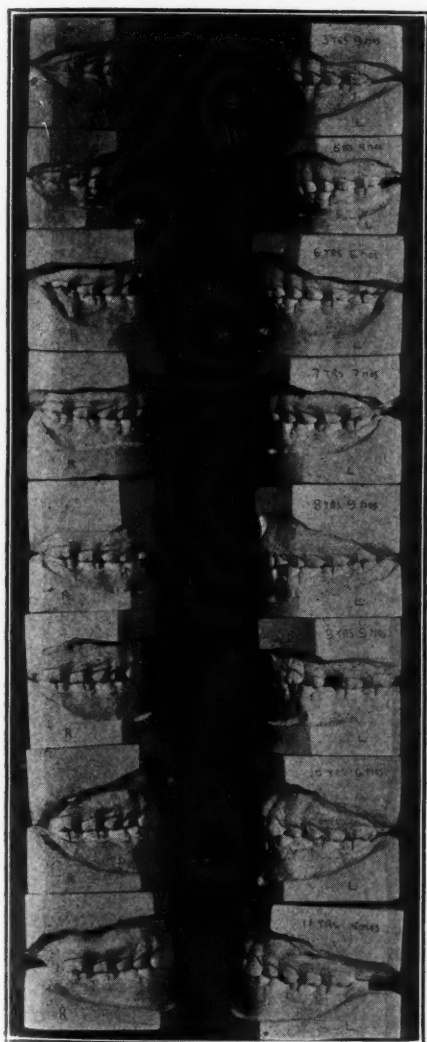


Fig. 5.



Fig. 6.

Fig. 5.—Molar adjustment at ten years six months on left side and lack of adjustment on right side.

Fig. 6.—Change from deep anterior overbite on left side at two and one-half years to an edge-to-edge bite at five years ten months.

development of a well defined Class II or distocclusion case. Fig. 8 illustrates a case in which there was a failure in molar adjustment due, apparently, to the rotation of the two maxillary lateral incisors, which acted as a mechanical interference. Other types of cases I have discussed in a paper read before the Pacific Coast Society of Orthodontists, which will appear in the *INTERNATIONAL JOURNAL OF ORTHODONTIA, AND DENTISTRY FOR CHILDREN*.

However, important as occlusion and occlusal changes during growth are in diagnosis, the problem must also be considered in relation to facial and jaw growth and development. A diagnosis based solely upon a study of occlusal relations has limitations. McCoy rightly states that we frequently deal with dentofacial deformities representing complex morphologic deviations involving not only the teeth and alveolar processes but also the jaws and, in many instances, some of the

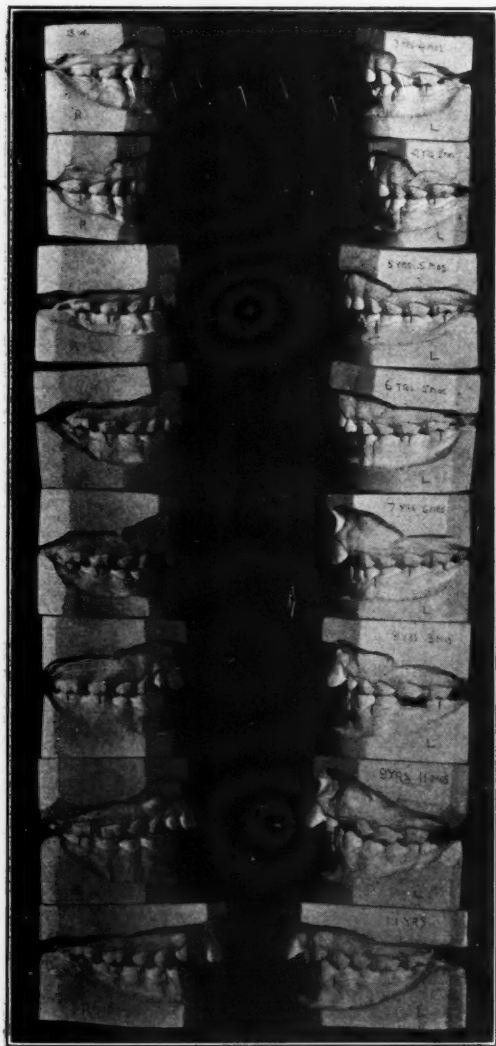


Fig. 7.

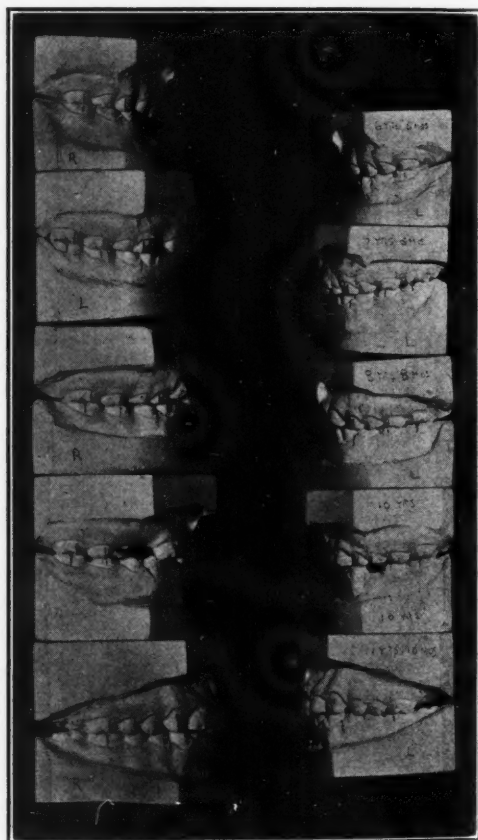


Fig. 8.

Fig. 7.—Normal occlusion at three and one-half and four and one-half years; developing Class II Division 1 at five and one-half years, and full Class II Division 1 from six and one-half years on.

Fig. 8.—Occlusal adjustment not good, due apparently to rotated maxillary lateral incisors.

external features. This broader conception of orthodontia requires a fuller knowledge of the development of the face, jaws, and teeth. Much can be learned from the studies of growth made by Hellman, Todd, Broadbent, and others.

Hellman has given us data on the growth of the face and its relation to the dentition which are of the utmost importance in diagnosis. The facts he has pre-

sented concerning the changes in the various parts of the denture in Class II and Class III malocclusions are also necessary tools in diagnosis. Todd has described in detail the skeletal adjustments in jaw growth, showing that growth is not continuous, but occurs in spurts, and that it consists of two processes; namely, increase in size and change in proportion. Recently Broadbent has perfected an x-ray apparatus which will allow him to study not only the growth of the entire head but also the relation between the growth of the denture and the growth of the head. He has already set up certain standards, and much that is valuable in diagnosis will be made available as his studies progress.

Some of you will ask, "How can we make use of this information in everyday practice?" Assuming a knowledge of basic principles of growth and development and a readiness to approach the problem from the biologic point of view, the first requirement is to reproduce the teeth and dental arches in such a way that you may see what relation the denture holds to the rest of the head. This means that instead of making a set of casts according to the old accepted method, we must reproduce the denture in such a manner as to show the true relations. Such a method was devised by Simon in his gnathostatic reproductions. A second requirement is reproducing the face by photographs made to scale. Simon has devised a method which is better than the older methods, though any type of photograph made to scale will answer the purpose. If it is not made to scale, it is worthless in making comparisons. A third requirement is a full set of roentgenograms, including intraoral as well as extraoral films, bite-wing films, and some type of profile roentgenogram. These allow us to study the local conditions around the teeth as well as the relation of the soft to the hard structures. Without them we are likely to grope in the dark when we attempt to evaluate the many conditions which are revealed only by good roentgenograms. A fourth requirement is a good history of the case. It need not be an elaborate history but should include all the factors which may throw some light on causal factors. A record of endocrine disorders in the individual and the family is important. Engelbach has given us a rather simple diagnostic index of pituitary disorders in his minimal and maximal height for weight chart, in a paper on "The Growth Hormone." A height and weight record may thus form a useful part of the history. Histories of other diseases may be useful; though at present they offer little help in our problems. It is important to have a record of any vicious oral habits, such as thumb-sucking, finger-sucking, lip-sucking, tongue-sucking, etc.

These are some of the requirements for diagnosis. But meeting them, essential as they are, will not fully solve our problem. That requires fuller information on growth processes. I have spoken of the importance of a knowledge of occlusion and occlusal changes in diagnosis, and also of the work of such men as Hellman, Todd, and Broadbent on growth of the face and jaws, which forms the groundwork for orthodontic diagnosis. We are not doing our duty to our patients or our profession unless we learn to put this knowledge into practical use.

There are other data, perhaps not so well understood, which are important in diagnosis. I mean the study of the local manifestations of growth processes in and around the teeth. From such a study we learn much about individual variations, some of which may be classified as coming within the range of normality, others as outside it, and a good number as on the borderline. For the past nine years we

have been trying to gather material along these lines at the Merrill-Palmer School and, more recently, in other institutions in Detroit. Though much remains to be done, we have learned a good deal about these local manifestations through a study of successive models of the teeth and dental arches in untreated cases. Those findings which are relevant to orthodontic diagnosis I shall present in part as they apply to the deciduous, the preadolescent or mixed, and the early adult dentitions. A discussion of the various conditions met with, the appraisals made in connection with these conditions, and the conclusions we arrived at may offer some insight into the intricate problems we all have to contend with.

When we examine the completed deciduous dentitions of young children, we are brought to a realization that almost every type of malocclusion encountered in the early adult dentition finds its counterpart in the deciduous dentition. The important point to consider is that, while our diagnosis may be the same, the treat-

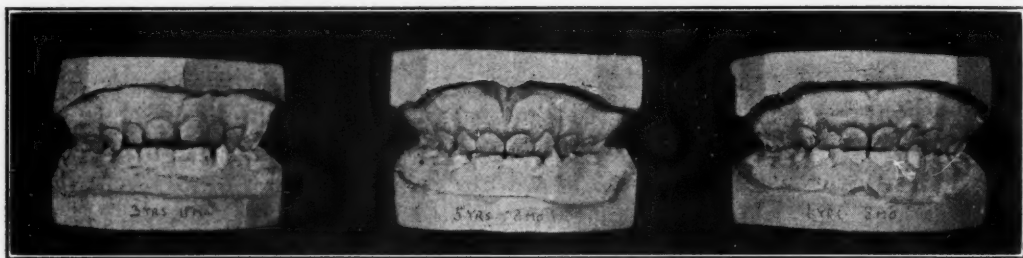


Fig. 9.—Malocclusion in deciduous denture, and normal occlusion in the mixed denture.

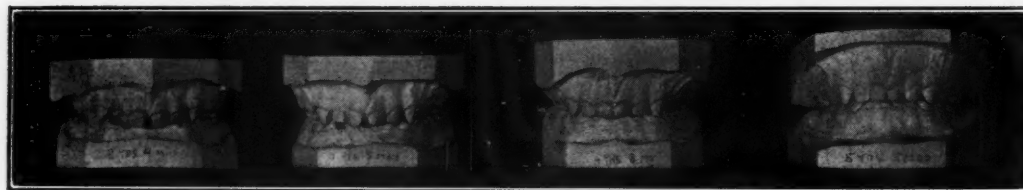


Fig. 10.—Deep anterior overbite until fifth year; normal overbite in sixth year.

ment of the case may differ materially in the two dentures. For example, if you found the type of malocclusion represented in Fig. 9 in the permanent denture, there would be no difficulty in diagnosing and classifying it for proper treatment. But it happens to be in the deciduous denture, and we have learned from experience that if the active agent causing this type of malocclusion is removed—in this case it was thumb-sucking—self-correction often takes place. Let us take a case of deep anterior overbite. Friel showed that as growth proceeds and wear takes place in the deciduous teeth, the mandible shifts forward, often opening up the bite. A good illustration of this process is seen in Fig. 10. Though the bite was very deep at first, it opened up as growth progressed. Here, as in the first case, our diagnosis would be the same had the condition appeared in the deciduous or permanent denture, but treatment might differ materially in the two instances. Not all deep overbite conditions correct themselves, as Fig. 11 shows. This was a Class II Division 2 case. In our experience these deep overbites never correct themselves. However, diagnosis should never overinfluence us in the decision as to treatment.

Growth proceeds by spurts, and we cannot know what nature will do in all cases. The same considerations hold for open-bite cases (Fig. 12). Though many cases of this type of occlusion have been attributed to vicious oral habits, our evidence is not conclusive. In this case caused by thumb-sucking, though the open-bite extended into the preadolescent denture, it finally corrected itself. Here again, though our

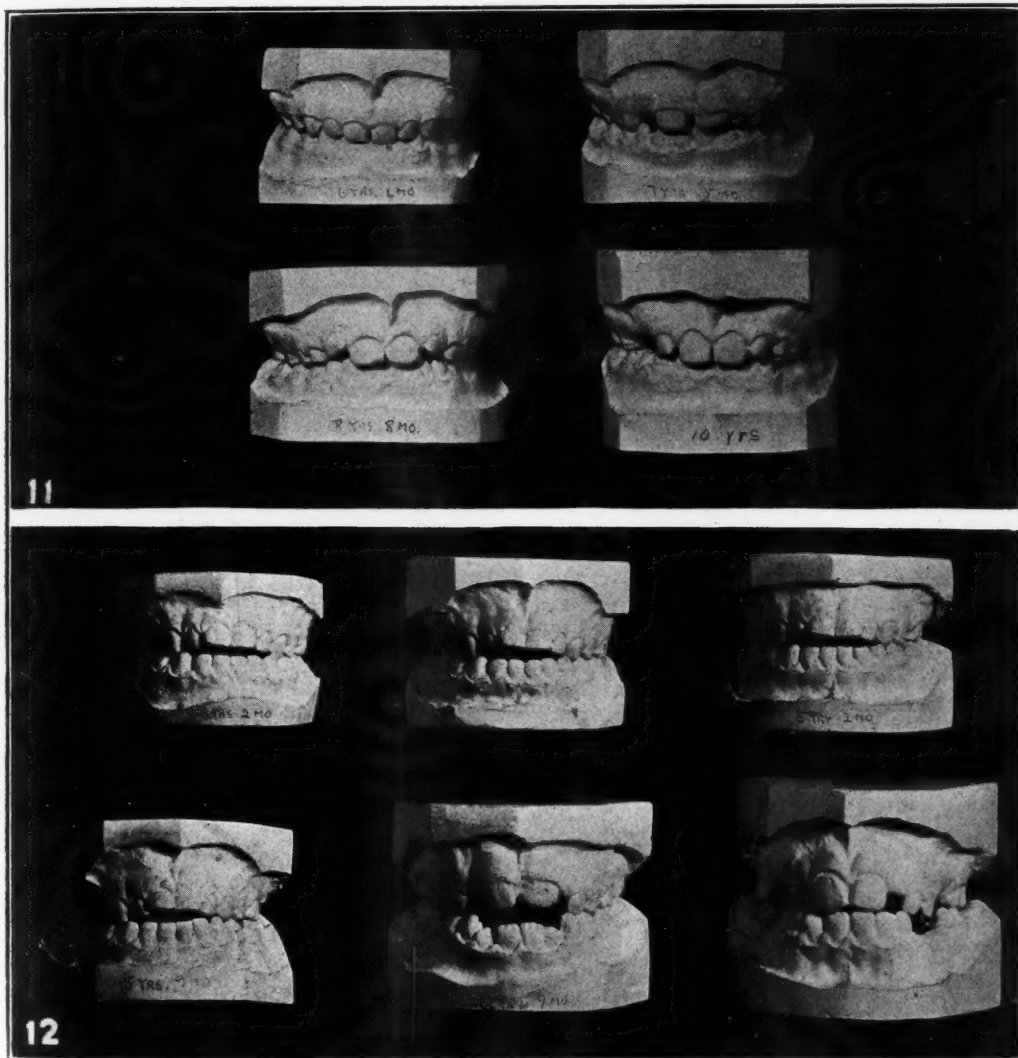


Fig. 11.—Deep anterior overbite not corrected. This is a Class II Division 2 case.
Fig. 12.—Open-bite case with self-correction at nine years of age.

diagnosis would be the same in any case, treatment itself would depend upon the phase of development represented by the denture.

Two other types of so-called malocclusion in the deciduous denture are represented in Figs. 13 and 14. Fig. 13 shows a case with inlocked maxillary lateral incisors. Is this malocclusion? Well, we may diagnose it as such, but the illustration shows what happened later. Fig. 14 shows a case with irregular incisors. Will an identical condition appear in the incisors of the preadolescent dentition? The

illustration shows that the condition has reversed itself, and I believe that regulating the deciduous teeth would not have prevented the opposite rotation of the permanent incisors.

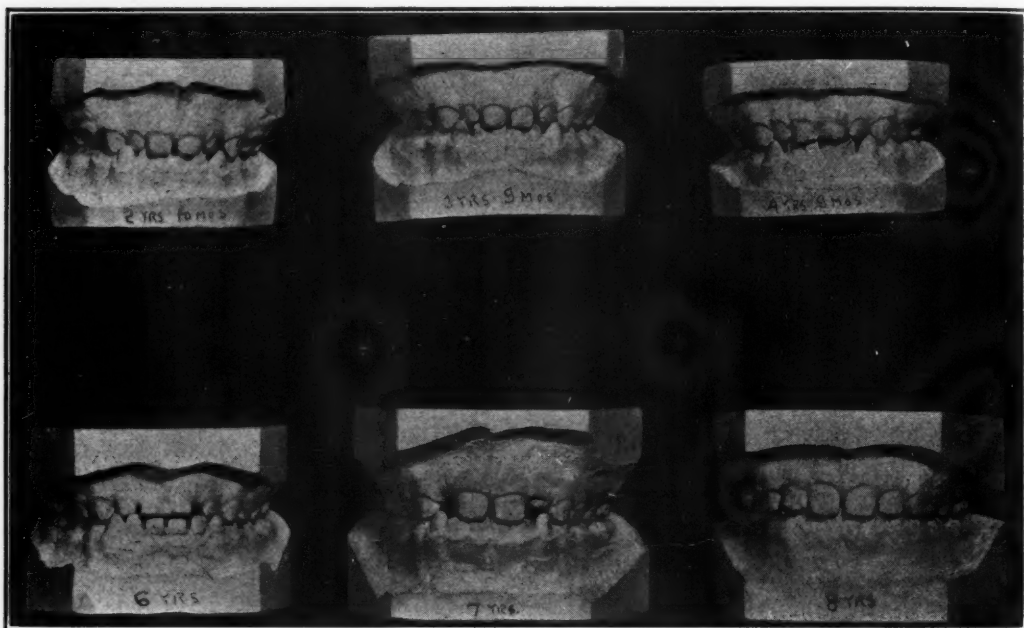


Fig. 13.—Inlocked maxillary deciduous laterals with normal occlusion when permanent maxillary laterals have erupted.



Fig. 14.—Maxillary deciduous central incisors rotated opposite permanent central incisors.

Many other types of cases could be shown, but I shall limit myself to a presentation of Class II, Division 1, and Class III cases, both typical and atypical. We know very little about the causative factors in Class II cases. We do know that in

our series no case has ever corrected itself. The diagnostic procedure is the same for the deciduous and for the permanent dentures, as concerns both the occlusal and facial aspects. There is some question as to the best time for treatment. The same holds true for diagnosis in Class III cases, but it is the opinion of most workers that once the diagnosis is made, treatment should be started, regardless of the possibility of endocrine disturbance or other causal factors. I am now speaking of the

OCCUSION

M.M.	N	I	II-1	II-1-5	II-2	II-2-5	III	TOTAL
22.0								
22.5		I						1
23.0								
23.5								
24.0								
24.5								
25.0		II						2
25.5		I						1
26.0	III		I					4
26.5		III I	I					7
27.0		III	I	I				5
27.5	I	II	I	I	I		I	7
TOTAL	4	15	4	2	1	0	1	27
28.0	III	III			I			11
28.5		III	I					4
29.0	I	III						5
29.5	I	III			I			5
30.0	II	III	I					7
30.5	I	II						3
31.0	I	I						2
31.5	I	II						3
32.0	I	I						2
32.5						I		1
TOTAL	13	25	2	0	2	1	0	43
GRAND TOTAL	17	40	6	2	3	1	1	70

BOGUE INDEX

Fig. 15.—Scatter diagram showing occlusal conditions with Bogue index.

deciduous denture. However, in making the diagnosis we must be on the watch for a condition which is often classified as Class III but is rightfully described as micro-development of the premaxillae. Correct treatment depends upon correct diagnosis. I believe gnathostatic casts and reproductions of the face might help us out of this difficulty.

Thus while many types of irregularities are met with in the deciduous denti-

tion, one cannot be sure that these always represent malocclusion, as such. With our present knowledge we cannot with any precision predict the outcome of the adult dentition on the basis of the deciduous dentition. Nor can we rely on any system of measurements now available to predict the final occlusal conditions on the basis of the deciduous dentition. The Bogue theories led many to think that we could, and his methods are still in use. But observation of many untreated cases

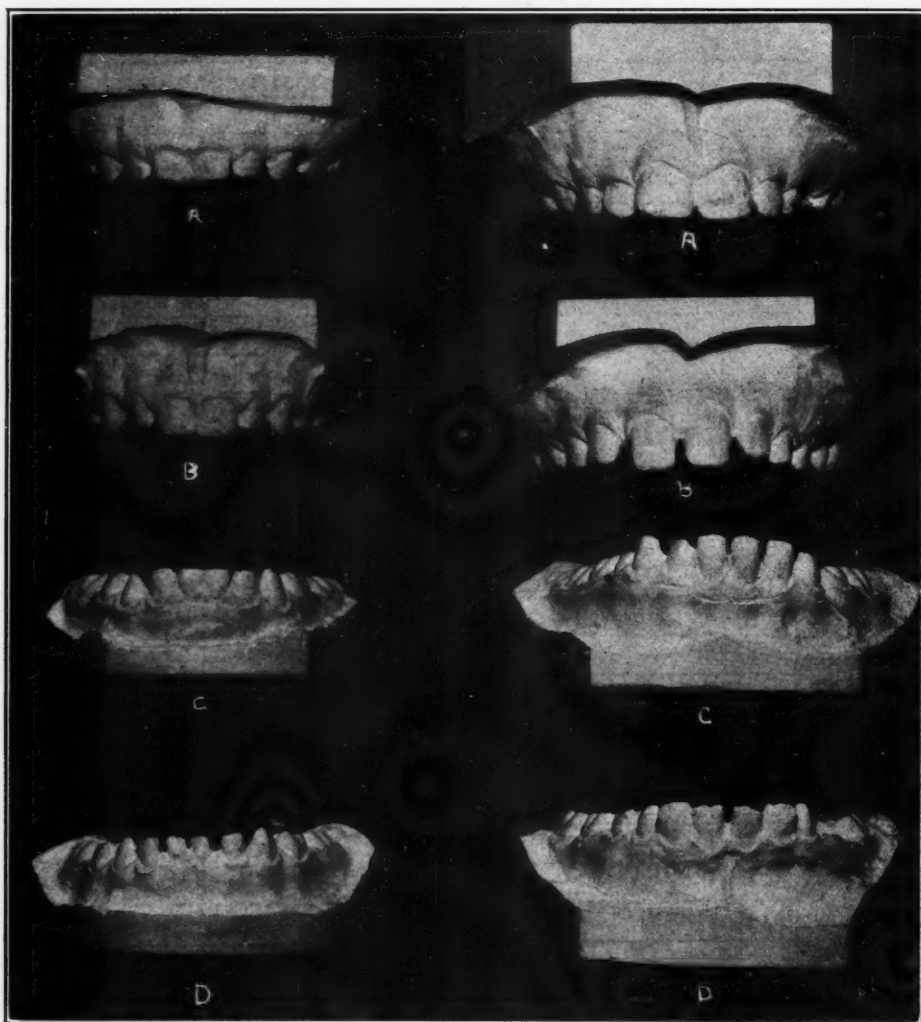


Fig. 16.—Showing relation between size of teeth and spacing.

shows that they cannot be used with any degree of accuracy (Fig. 15). Nor can we use the appearance of so-called developmental spaces as a diagnostic sign of developing malocclusion. In a quantitative study we made a number of findings of importance in diagnosing developing malocclusion. We found a definite relation between spacing and the size of the teeth. If the teeth are relatively small, there is likely to be spacing between them; if they are relatively large, there is likely to be no spacing (Fig. 16). Very little, if any, relation was found between spacing, or the appearance of spacing, in the incisor region before the deciduous incisors were

shed and the alignment of the permanent incisors. Larger spacing in the mandible tended to be accompanied by more regular alignment of the permanent incisors. But the spaces appeared when the deciduous incisors were erupted, and not later. Figs. 17 to 20 illustrate some of the conditions met with.

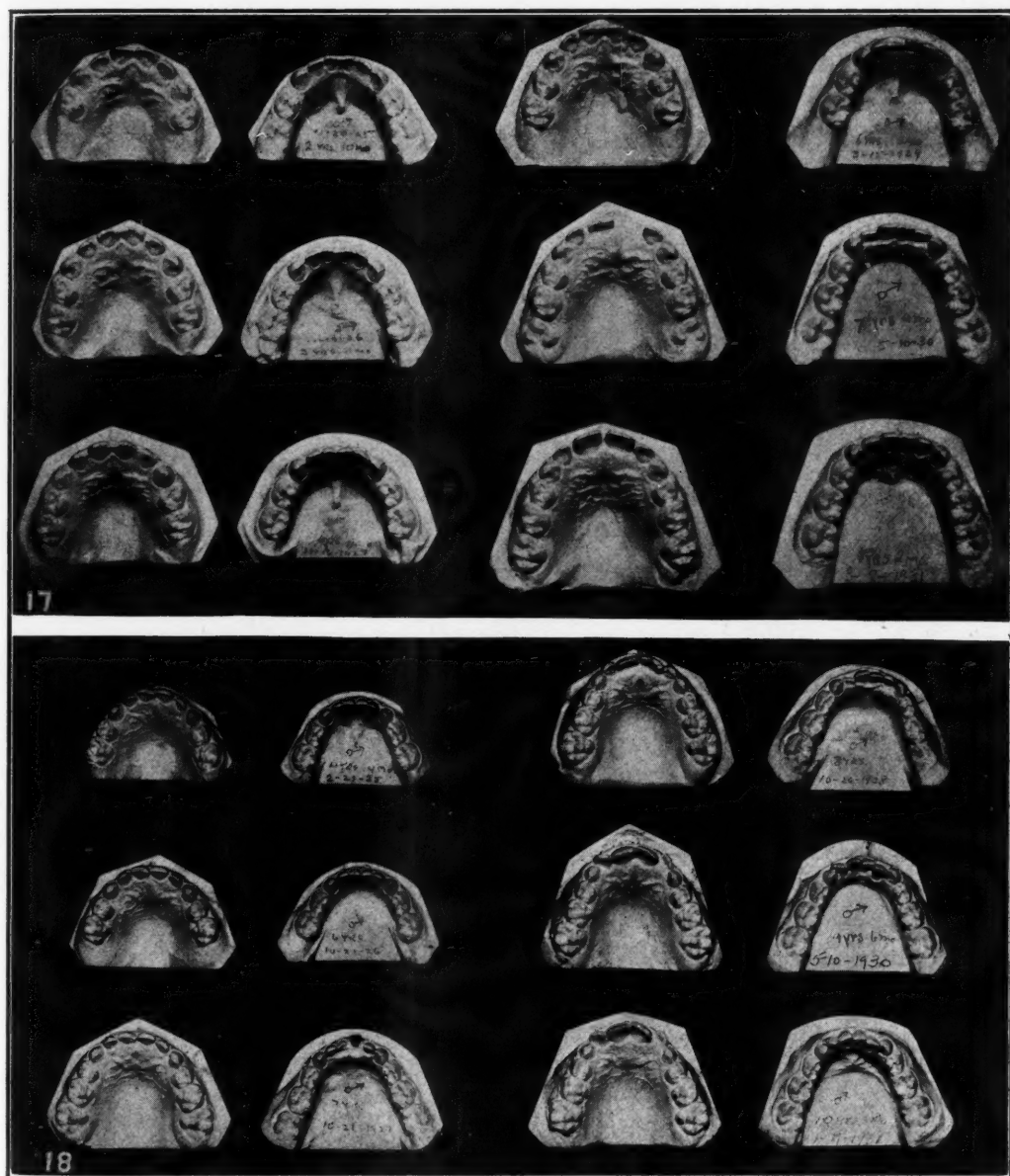


Fig. 17.—No incisor spacing in mandibular arch with normal incisor alignment.

Fig. 18.—No incisor spacing with malalignment of mandibular permanent incisors.

These complex conditions illustrate the need for exercising caution before making a positive diagnosis of malocclusion in the deciduous dentition.

At present our diagnostic methods with respect to the preadolescent or mixed dentition are somewhat confused. At this age there is a state of flux in the denture. Growth processes are everywhere evident. Individual variations in both morphol-

ogy and function appear. The face as well as the dentition changes rapidly. The child is growing up, passing into the preadolescent period of growth. At this time

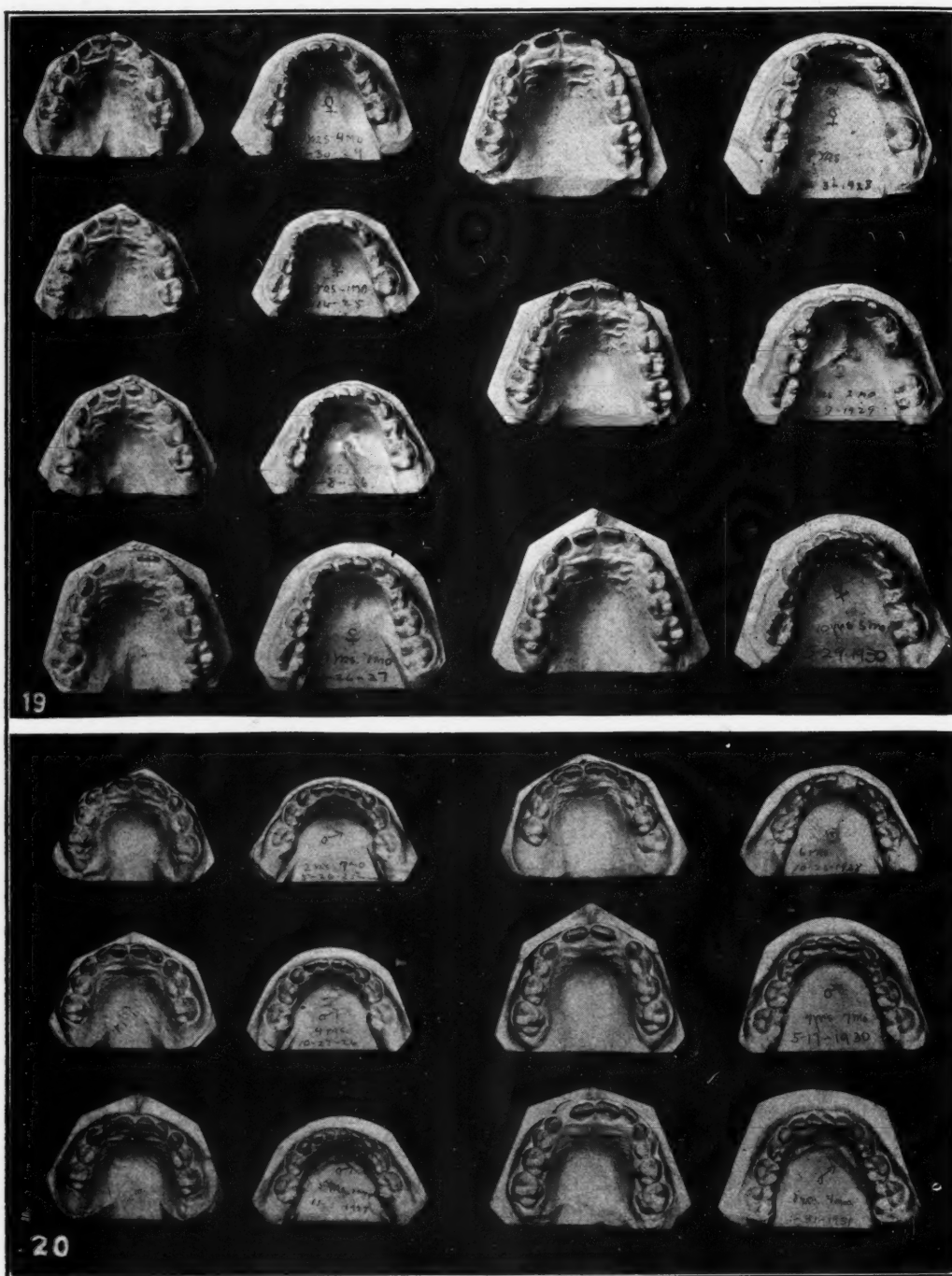


Fig. 19.—Wide maxillary and mandibular incisor spacing with normal alignment of permanent incisors.

Fig. 20.—Wide maxillary and mandibular incisor spacing with malalignment of permanent incisors.

it is difficult to determine what is normal in the denture and what is abnormal. The dental arches have attained almost the maximum in width growth; that is, about

five-sixths of it. The intercanine growth has started and will continue until about the twelfth year. The face is moving out from under the brain case and is rapidly gaining in height. The jaws are increasing in length. While all this is taking place, the teeth are growing, erupting, changing positions in the arch, and taking their place in the occlusal scheme. So many variations occur in this complex process that it is impossible in most instances to say what is and what is not maldevelopment. Orthodontists hold two points of view in the matter: one that malocclusion is a pathologic phenomenon and unless treated at once will lead to sequelae detrimental to health; the other that it is a development phenomenon and if let alone in the early stages will in many cases improve. But here we may be haggling over terms. What should interest us most is the methods we should use in diagnosing malocclusion or developing malocclusion in the light of our best knowledge.

We will all admit that there is still much to be learned regarding the changes occurring in the preadolescent period. This is true of both the general field of growth and the special dental field. Our methods of appraisal are not all that we could wish, but a review of the available materials shows that already we have much sound information on which to base our diagnosis. We should have at our command, first of all, a knowledge of the successive changes taking place during the development of the face and jaws. A knowledge of the eruption of the teeth, especially of the time required for the teeth to come into occlusion, is of paramount importance. However, this is only one phase of growth. We need much more knowledge of the growth of each tooth from the time the crown is laid down until the time when the tooth is completed and in occlusion. I have attempted a study of the growth of the teeth on the basis of four hundred sets of intra- and extraoral roentgenograms. This study, which was reported in San Francisco, February, 1932, is only a beginning, but it has brought to light many interesting points which further observations and more material will enable us to evaluate. Material of this kind should help us to determine what constitutes the normal range of variation.

It is essential that we should have a knowledge of the many changes in the teeth and jaws and dental arches during the preadolescent period so that we may determine what is normal in occlusion, what is abnormal, and what is on the borderline between the two. At the Merrill-Palmer School and through the agency of the Children's Fund of Michigan, we are attempting to gain some light on this problem through a study of many untreated cases over a period of years. We have learned much and are learning more every day; but, if we are to go far, many more workers must enter this field of investigation.

I shall present as briefly as possible what seem to me the important requirements for diagnosis in the preadolescent dentition, and the factors that must be considered in making the diagnosis.

In discussing the deciduous dentition I spoke of the diagnostic value of the spacing of the deciduous incisors, the measurement of the width of the dental arches, and occlusal changes during growth, especially as related to molar changes and anterior overbite conditions. All these factors must be kept in mind in diagnosing developing conditions in the preadolescent dentition.

Another consideration in diagnosis is the truism that a tooth out of alignment is not necessarily a tooth in malocclusion. Some teeth improve their positions in the arch during growth; others do not. It is true also that occlusion in some cases

improves during growth, and in others does not. At first we were inclined to believe that unless there was improvement by the sixth year in thumb-sucking and open-bite cases there was little chance for self-correction. We now know that changes may take place later than we thought possible. We have also found that in some cases this correction carries over to the permanent dentition. Fig. 21 shows a

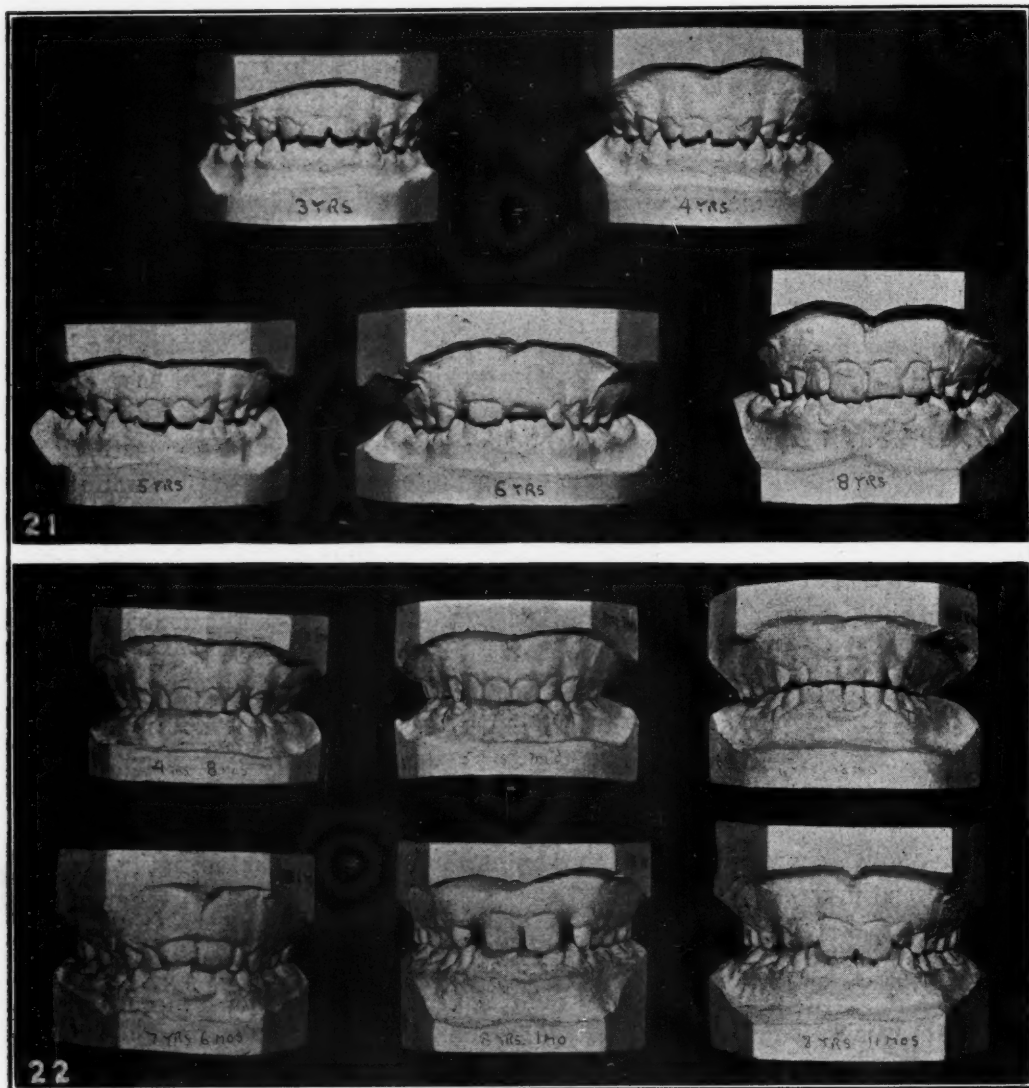


Fig. 21.—Self-correction of thumb-sucking case that carried over into the permanent denture.

Fig. 22.—Thumb-sucking case, self-corrected in deciduous denture that did not carry over into permanent denture.

case in which it did. I have mentioned a case of open-bite that corrected itself after eight years of age, but, as our cases show, this correction does not always occur (Fig. 22).

Using such means as we have at our disposal in diagnosing malocclusion, we find that over 50 per cent of the cases of normal occlusion in the deciduous denture have become cases of malocclusion by the time the four permanent incisors, maxil-

lary and mandibular, are erupted and in occlusion. What may happen later we cannot tell until all the permanent teeth of the early adult dentition have fully erupted. A few cases from our collection will illustrate in some measure what is happening during this important period (Figs. 22 to 28).

I should like to say a few words about the relation to malocclusion of the early loss of the deciduous teeth. As a result of nine years of study, I cannot recon-

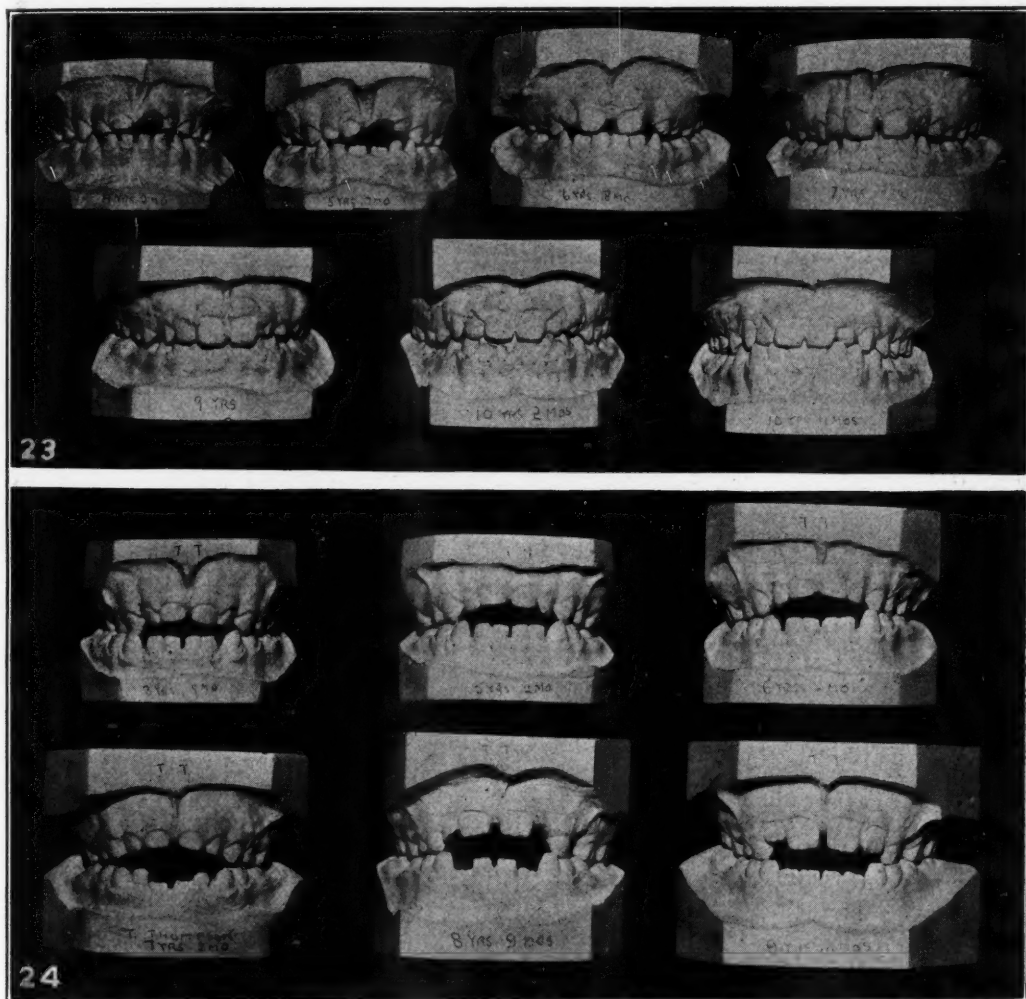


Fig. 23.—Thumb-sucking, premature loss of maxillary deciduous incisor and wide diastema between maxillary central incisors followed by normal occlusion. No appliances were used in this case.

Fig. 24.—Thumb-sucking case where habit was not broken. Malocclusion still persists.

cile myself to the statement of many writers and teachers that malocclusion necessarily follows the premature loss of a deciduous tooth. We have found various conditions occurring after the premature loss of deciduous teeth. Sometimes the space closes, sometimes it remains stationary, and sometimes it gets larger. In some cases there is no apparent damage, and the end-result is normal occlusion as we know it. Sometimes occlusion suffers considerably. In some cases the space has almost closed when a spurt of growth occurs and the space opens to receive the on-

coming tooth. The early loss of maxillary incisors, unless they are protruding, is seldom followed by a closure of the space. Usually it becomes larger. When mandibular incisors or maxillary or mandibular canines are lost, the space usually

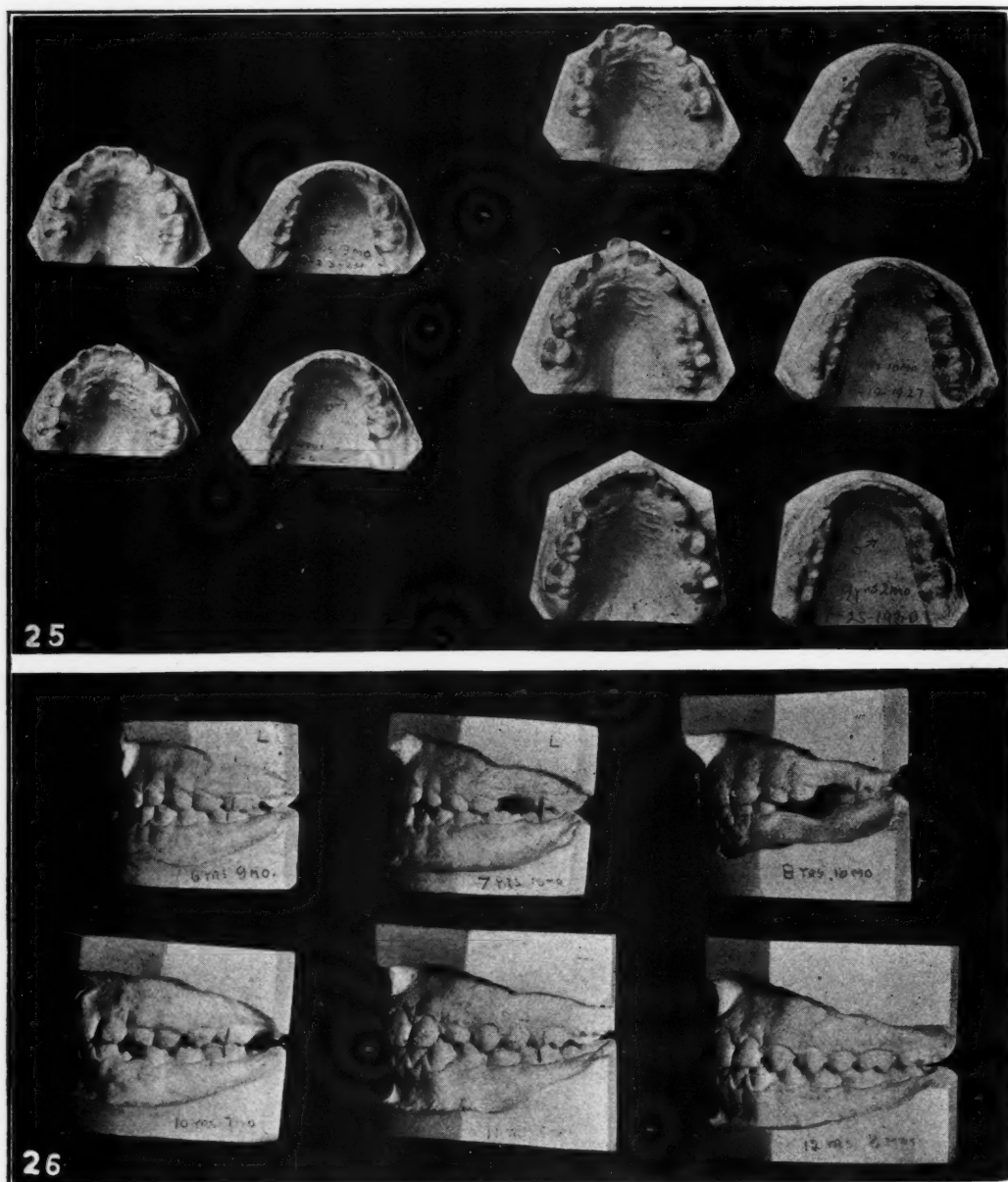


Fig. 25.—Premature loss of deciduous teeth followed by malocclusion.

Fig. 26.—Premature loss of deciduous teeth followed by normal occlusion.

closes. The type of occlusion in the remaining teeth and the position of the tooth in its crypt seem to influence in some way the change that occurs.

It would seem therefore that in diagnosing developing malocclusion in the pre-adolescent dentition we are dealing with problems of development and must therefore use what Gesell calls developmental diagnostic methods. That means that the

child's make-up and growth potentialities should be estimated by a series of examinations in which each becomes a check on all the preceding. Gesell concludes that "after all, it is not the status at a given moment, but the growth characteristics of the individual career which are important from the standpoint of child health and protection. Periodic diagnosis then becomes the basis for developmental su-

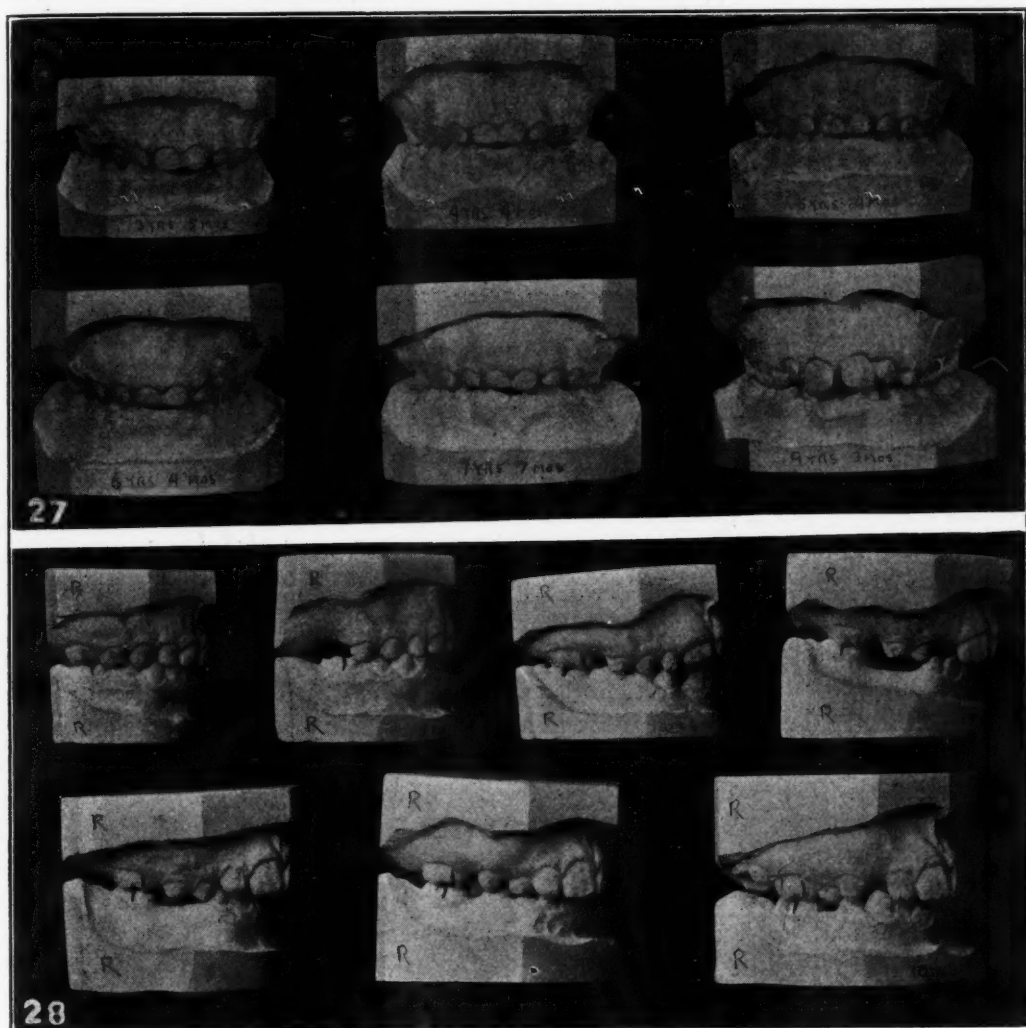


Fig. 27.—Protrusion of maxillary deciduous incisors with distoclusion followed by more marked protrusion of permanent incisors.

Fig. 28.—Normal occlusion in first model followed by malocclusion and partial self-correction in last model. Note change in permanent molar relation and self-opening of space for maxillary second premolar.

pervision." This is our problem in diagnosing malocclusion in the growing denture. The question is, are we meeting it?

Diagnosis of malocclusion in the early adult dentition presents a somewhat different problem. After the eruption of the second permanent molars, there is little if any further width growth of the dental arch and face. The arch increases in width somewhat at the time the third molars erupt and some facial changes occur, but in the main occlusal conditions found after the twelfth year are likely to be

end-results. Accordingly, diagnosis at this time involves a consideration of occlusal conditions and deviations in the jaws and face. It is important therefore that we have good reproductions of the denture and face and such a complete roentgenographic survey as I have described earlier in this paper.

In general, the use of the Angle system of classification will simplify diagnosis. I do not mean to say that Angle's system is perfect or that the question of the constancy of the position of the first permanent molar is a closed one. But with a broad-minded point of view and some modifications the system can be utilized to great advantage, as is evidenced by the work of many of our most successful orthodontists, past and present.

In diagnosing upon the basis of occlusal conditions it is well to realize that the mesiobuccal cusp, buccal groove relation of the first permanent molars is not a reliable sign. Of more importance is the relation of the mesiolingual cusp of the maxillary first permanent molar and the central fossa of the mandibular first molar. The use of this relation and Hellman's occlusal scheme will prove of first-rate help in diagnosing malocclusion on the basis of the occlusal aspect of the denture. I cannot stress too much the importance of Hellman's functional scheme as outlined in his work on "Variations in Occlusion." Incipient molar rotations can be diagnosed better with such a scheme than with the old inclined plane scheme, and molar rotations are of increasing importance in diagnosing malocclusion in the preadolescent and early adult dentures.

We should have a knowledge of causative factors in malocclusion, but at present we know so little about them that we must content ourselves in most instances with a diagnosis on the basis of the symptoms presented.

I am fully cognizant of the present controversy regarding the diagnosis of Class II and Class III cases. It is certainly not beyond the range of possibility or probability that the maxilla in Class II cases might be in a forward position in relation to the head and the mandible be neither in a backward position nor undeveloped. Class III cases present the same possibilities, as Hellman has pointed out in his facial studies. We have not settled the problem as yet and shall not until more evidence is forthcoming, but work such as Broadbent is doing in the Bolton Laboratories at Western Reserve University will go a long way toward clearing up the situation, and we should all look forward to the reports he will make. The material he and Hellman and others are giving us is of the greatest importance for orthodontic diagnosis.

A survey with the Stanton machine is highly desirable as an aid to orthodontic diagnosis, especially when the amount of tooth substance is not harmonious. I shall not discuss Stanton's theory of arch predetermination, but if one wishes to find out whether or not the teeth of one jaw will occlude properly with the teeth of the opposite jaw, there is no better method available than surveying with Stanton's machine.

In Class II, Class III, and open-bite cases, one should utilize all the available material on morphology. If such conditions are diagnosed solely on the basis of the occlusal relations, the operator is often in the dark as to the true condition. Whether or not these conditions are accompanied by a short or long ascending ramus, a study of face and jaw measurements, gnathostatic casts, facial reproduc-

tions, and profile x-ray pictures will give the operator a better picture of the conditions than is now common, and may lead to a better diagnosis.

Though this paper can make no pretense of covering every point in the requirements for orthodontic diagnosis, I hope that it has in some measure fulfilled the purpose in planning such a symposium.

SUMMARY

1. The problem of orthodontic diagnosis requires an inquiry into underlying principles. Some of the questions confronting us are: What constitutes malocclusion? Is it a pathologic or a developmental phenomenon? What individual variations must be taken into account in differentiating normal or typical growth changes from abnormal or atypical changes?

2. Adjustments during the growth process constitute an important consideration in orthodontic diagnosis. We require, besides a knowledge of occlusion, in which the studies of Hellman and Friel are important, a knowledge of the development of the face, jaws, and teeth. In this field the studies made by Hellman, Todd, and Broadbent are important.

3. The physical equipment for orthodontic diagnosis should include: a reproduction of the denture in such a way as to show the true relations; photographs of the face made to scale; a full set of roentgenograms, including both intraoral and extraoral films, bite-wing films, and some type of profile roentgenogram; a good history. Basic knowledge required for diagnosis includes a fuller understanding of growth processes than we now possess and more data on the local manifestations of growth processes in and around the teeth.

4. Almost every type of malocclusion found in the early adult dentition has its counterpart in the deciduous dentition. Though the diagnosis may be the same in each case, the type of treatment must depend upon the stage of growth and development.

5. In diagnosing malocclusion in the preadolescent or mixed dentition we are dealing with a developmental problem and must use developmental diagnostic methods.

6. Diagnosis of malocclusion in the early adult dentition requires a consideration of occlusal conditions and deviations in the jaws and face.

7. The use of Angle's system of classification and Hellman's occlusal scheme will simplify diagnosis. When the amount of tooth substance is not harmonious, a survey with the Stanton machine is desirable. In Class II, Class III, and open-bite, cases, all available material on morphology should be considered.

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WHAT ARE THE REQUIREMENTS OF ORTHODONTIC DIAGNOSIS?*

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IN MEDICINE and surgery, it is generally acknowledged that diagnosis constitutes one of the most important parts of practice, for it comprises all methods and procedures employed to determine the nature and extent of diseases and deformities.

The widespread belief that the diagnosis of a dental anomaly is usually a simple matter, that the classification of its dental malocclusion includes the diagnosis, is certainly erroneous. All too frequently the practitioner fails to procure the essential data upon which every diagnosis should be based, attempts to prosecute his tasks without fully acquainting himself with the intricate nature of the problems confronting him, and proceeds with the treatment of a deformity without making or completing the diagnosis.

While it is true that sundry forms of malocclusion of the teeth respond favorably to standardized, mechanical orthodontic treatments, an appreciable number of dentofacial deformities do not yield readily, nor completely. Strive as he may, every orthodontist eventually garners his quota of failures, regardless of the methods of treatment he employs in his practice. Some of these failures, undoubtedly, are due to faulty diagnoses.

It is very rare indeed for only one tooth to be malposed; usually several teeth and their supporting alveolar process are involved. Not infrequently, the entire denture presents anomalous relations, though the several parts are variously affected. In still other instances, the bony structures of the jaws and the conformation of external facial features may be deformed. Lastly, since a dental anomaly may result from endocrine dysfunction and require more than mere mechanical therapy, the diagnosis should embrace biochemical procedures provided by the physician.

Thus, it is obvious that the widely used phrase "malocclusion of the teeth" does not adequately express our comprehension of dental anomalies, that the further, finer and more precise development of our diagnostic methods is desirable and urgent, not only to increase our knowledge but to advance our skill and reduce the number of our failures.

In response to the question which serves as title for this symposium, I offer the following brief description of the indispensable data which every practitioner should procure prior to completing the diagnosis of a dentofacial deformity.

1. THE WRITTEN RECORD

Every orthodontic case history should contain much pertinent information which is never recorded in such objective material data as plaster denture and

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photographic facial reproductions. The written portion of the record should fulfill the following definite requirements:

(a) It should contain relevant facts of the patient's history. By asking a number of suitable questions, one may gain important knowledge of the teeth of parents and other relatives, whether they are normal or required orthodontic treatment; the facial form of the parents, brothers and sisters. Inquiry of any serious illness during infancy should also be made. Recurrent attacks of "colds," the presence or removal of adenoids, hypertrophied tonsils and other affections of the nose and throat; the manner of feeding during infancy; the age when the deciduous teeth began to erupt, to determine tardiness or prematurity of the process; the possible influence of various habits, and of traumatic, congenital and hereditary factors, should all be considered and recorded.

(b) Observations and examination of the patient's mouth and teeth should then be begun to note the facial form and expression; the function of breathing; the relations, form and size of the lips; the relative size of the teeth; their number, form and structure; those affected by caries; the number, kind and location of restorations; the pulps affected by disease, if any; the condition of the gums, etc.

Measurements with suitable calipers of the length and bilabial height of the oral fissure; of facial width and height; of head width and height, and computation of the facial and cephalic indices may also be executed.

(c) The etiology of dental anomalies is not well understood, but space on the written record should always be provided for recording such causative factors which the practitioner observes and which his data may reveal. If these findings are indexed, the records of an orthodontist will, in time, furnish valuable information. Total disregard of these problems will never solve them.

(d) Diagnosis during examination should always be tentative, for it can seldom be concluded without denture and facial reproductions and further study. However, the natural occlusion of the patient's denture should be entered on the record at this time. The terms I suggested in 1911, namely, neutroclusion, bilateral and unilateral distocclusion, bilateral and unilateral mesiocclusion, are applicable during this preliminary survey and are helpful during the subsequent construction of the plaster denture reproductions.

(e) An orthodontic prognosis is a forecast of the probable result of the anomaly, and most parents are grateful for an opinion from the practitioner concerning their child's deformity. Of course, these judgments necessarily depend upon the conditions found and vary with the ability and training of the observer, but they should always receive careful consideration. Whatever the verdict in a given instance, the operator should invariably make a brief record of it on the history or record sheet. (This also applies to his explanations of the treatment required.)

In my experience, I have found it convenient to compile the greater portion of a written record during the limited time when the parents are present. This is done on examination forms prepared for the purpose and which are duplicates of the permanent record forms. (They are a pale straw color to distinguish them from the latter.) After the other data about to be described are at hand, I then review them carefully and systematically. Corrections and additions are made when necessary, and, if the patient is accepted for treatment, this record is then copied on white permanent forms with a typewriter.

Every practitioner will find it advantageous to employ a secretary, and every worthy secretary will take pride and interest in keeping records. She usually finds such an important task a welcome and instructive change from the monotony of the day's work. She should also be taught how to compile an index of all important data which such records contain. Without comprehensive statistics, orthodontics will never achieve the goal it deserves. Our services are too important to patients and our obligations to the art too compelling, for us to undervalue scientific records; but even such records are more useful if they are properly catalogued and made accessible.

2. PHOTOGRAPHIC FACIAL REPRODUCTIONS

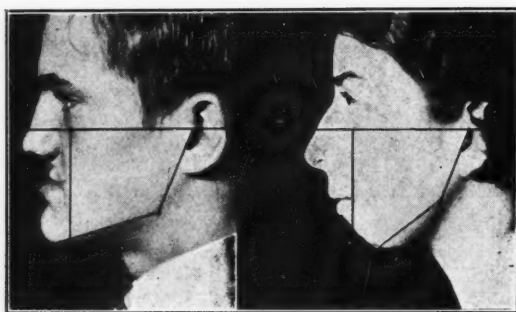
Any one who undertakes the treatment of dental anomalies becomes interested in the facial deformities which so frequently complicate them. This concern may vary from a desultory regard for a patient's comeliness to a sincere attempt to understand their real significance. It is a serious mistake to form a hasty opinion on such an important matter and to conclude that facial deformities of this nature are inconsequential symptoms which will disappear, or at least be improved, if orthodontic treatment be applied to the dental anomaly. That naïve attitude of the days of our orthodontic infancy is partly responsible for the inertia which retards our growth. Fortunately, a more precise judgment is gaining acceptance, one which believes that facial involvements present diagnostic data of very great value.

When we consider that the customary dental models only record relations of the teeth and rarely disclose the possible deformities of the jaws, that the usual unmarked facial photographs always fail to reveal the underlying dental deviations which stand in causal relationship to the facial deformities, we can readily understand why some orthodontic treatments are not successful. It should be obvious that these widely used diagnostic data of a given patient can be so unrelated, if certain necessary precautions are not observed during their procurement, that they may forfeit most, if not all, of their scientific value. Every orthodontist can sharpen his powers of observation and improve his diagnostic acumen far more rapidly by recording every patient's face, than is possible by mere momentary notation.

Our interest in the lower half of the morphologic face (the "changeable area," as the late Dr. Case called it) compels us to examine the points, lines, angles and conformation of the features found therein, as well as the deformities which we universally accept as symptoms, complications, or consequences of dental anomalies. Our diagnostic approach should be based on morphologic principles, so that the form relations of the denture and its relations to the patient's head and face may be definitely determined. To ascertain these with comparative ease and accuracy, Simon devised gnathostatic diagnostic methods in which photostatic procedures form an integral part. Moreover, these methods are so standardized, and the equipment for executing them is so perfected, that any one willing to learn may now avail himself of their use and value.

Time and space prevent comprehensive presentation of the importance of photostatic facial reproductions. Suffice it to say that when the mandible is excessively developed or retarded, the deviations are too momentous to be ignored.

Every such deformity is distinctly recorded by this method and may be readily evaluated if the facial reproductions are made to scale, if certain cephalometric points like the gonion and orbitale are marked previous to the exposure. (Fig. 1.) When the height of the lower third of the face is involved, because of extreme so-called overbite, or the reverse, so-called open-bite, the distance from subnasion to



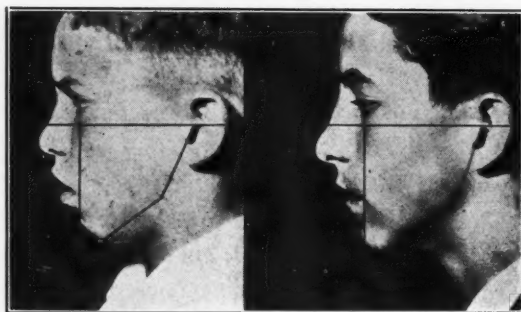
A

Fig. 1.

B



Fig. 2.



A

Fig. 3.

B

gnathion may be affected. (Fig. 2.) In appraising the value of a given treatment, e. g., of total mandibular retraction, a subsequent photostatic facial examination will reveal its progress. (Fig. 3.)

3. PLASTER DENTURE REPRODUCTIONS

Plaster models have long been accepted as essential parts of orthodontic case records and deemed indispensable in diagnosis. They can be constructed in va-

rious ways and are occasionally referred to as study models. All plaster reproductions made for diagnostic use should be worthy of study, but, unfortunately, most of them are not. "Snap" impressions and models have little, if any, scientific value, are entirely obsolete and should be discontinued. "Artistic models" are, as their name implies, *models*, i. e., they are show pieces. These may be very accurate in some particular details but lose most of their diagnostic value when unrelated to the patient's head.

Fig. 4.

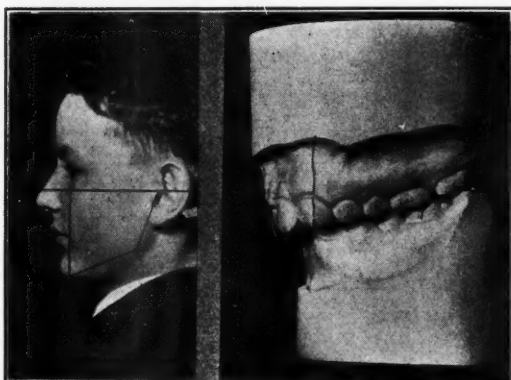


Fig. 5.

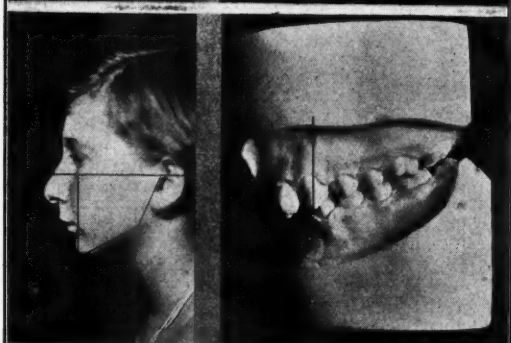
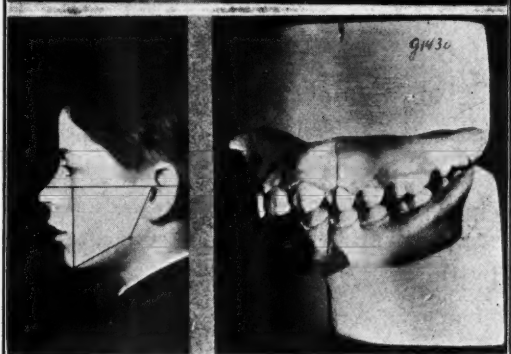


Fig. 6.



I am not advocating slovenliness and inaccuracy of technic, but our diagnostic data are not, primarily, museum pieces. We should avoid emotional attitudes in a matter of this kind, should strive to produce plaster denture reproductions which fulfill definite scientific demands and wean ourselves from the mood and mode that overemphasize artistic qualities by sacrificing scientific requirements. After all, the purpose of a reproduction is realistic, not idealistic.

If our denture reproductions are constructed with the aid of a gnathostat and

in accordance with cephalometric principles, we record not only several very desirable dental details but also dentocranial relations. For example, we have long agreed that a dental arch may be too narrow. But is this due to a dental contraction (i. e., are only the coronal portions of the teeth too near to the median, sagittal plane), or is the alveolar process similarly involved? The nature or form of deviation is important; it determines the kind of treatment required. In other words, intelligent treatment presupposes careful differentiation.

To cite another example: Every orthodontist recognizes so-called distoclusion. But is the apparent posterior relation of the mandibular arch confined to the teeth? (Fig. 4.) Or, may it be due to an arrest of development of the man-

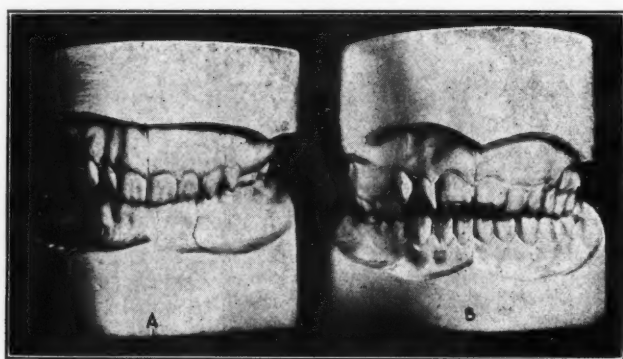


Fig. 7.

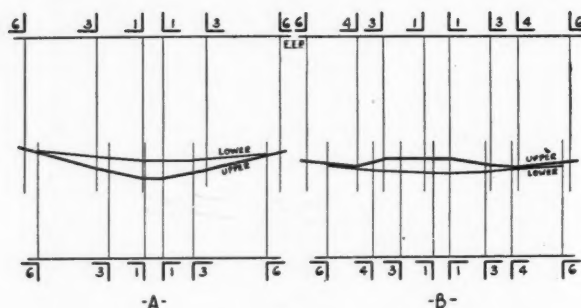


Fig. 8.

dible? (Fig. 5.) Again, may not the maxillary teeth occupy an anterior position in relation to the face and mandible? (Fig. 6.) All of these possibilities are met with and may readily be diagnosed with the aid of gnathostatic denture and photostatic facial reproductions. In some instances, when differentiation appears difficult, three-dimensional graphs can be drawn and norm-patterns marked on them to facilitate accurate appraisal. (Figs. 7 and 8.) Thus, we gain a much clearer understanding of the anomaly. It enables us to localize and evaluate the extent of the deviations in a manner heretofore believed impossible.

4. RADIOGRAPHIC DATA

Radiography has been employed in oral diagnosis for more than thirty years and has conclusively demonstrated its value. Simpson has aptly stated that "a thorough radiographic examination requires an intimate knowledge of the regional

anatomy, a keen discrimination of the physiologic and pathologic factors involved, an appreciation of the limitations encountered, and an acute sense of obligation toward the service. These qualifications are acquired only by professional training and extensive clinical experience, and even this preparation is not infallible."

The well-developed technic of radiography enables us to procure adequate intraoral, extraoral and verification films. A comprehensive, thorough interpretation is always advisable as a diagnostic procedure, for we are thus better qualified to differentiate the anomalies of eruption, form, number and position of the teeth. It is also desirable to examine critically the condition of alveolar crests and septa of the teeth involved in the anomaly, and of root ends and periapical areas. The presence of incipient dental caries and abnormal pulp conditions, as well as deciduous root remnants and foreign bodies, may also be determined by the aid of radiographs.

5. THE DIAGNOSIS OF A DENTAL ANOMALY

An orthodontic diagnosis has been defined by Simon as "the search for, and determination of, the difference between the existing denture of a patient and the condition to be established."

Because an anomaly is not a disease but a deviation of form and structure, it follows that the diagnosis of a dental anomaly is a morphologic problem. It should therefore, heed the three dimensions, so that we may ascertain the form relations of the patient's denture and, with the aid of the gnathostatic denture and photostatic facial reproductions, discern the relations of the denture to the head and face.

After the various objective data described above have been procured from a given patient and prepared for critical analysis, the diagnosis can always be made with greater certainty. Such a procedure helps us to establish the real nature of the deformity and minimizes the danger of being swayed by prejudices or preconceived notions. Far too many orthodontic diagnoses have been based on subjective opinions.

Since the top or base of the gnathostatic maxillary plaster reproduction represents the horizontal eye-ear plane, and the base of the mandibular cast is made parallel to it, and because the median and transverse orbital planes are marked on them during their preparation, we augment our ability to evaluate the existing deviations in the three dimensions of height, width and length.

By employing the planes as base lines, we can determine the symmetry or asymmetry, and the transverse and sagittal relations of each dental arch, and with the aid of measurements from them, we judge the kind and degree of the various deviations. Bearing in mind the topography of the denture (Fig. 9), we can also differentiate the deflections into dental, alveolar and maxillary for the upper, and dental, alveolar and mandibular for the lower. Viewed horizontally, we can localize the deviations as follows: anterior, posterior, total, unilateral and bilateral. With the aid of the photostatic profile, we can differentiate mandibular involvements into horizontal and vertical and note modifications of the angle.

In conclusion, I cannot forbear to mention that nearly every criticism of these methods has inappropriately emphasized the variability of organic forms and assumed that the universal occurrence of variation precludes the use of measurements. Critics seem to forget that while Bateson pointed out in 1894 that varia-

tion is "as much a part of the specific characters of organisms as any other feature of their organization," he also said that "few will still ask us to believe that the fixity of a character is a measure of its importance to the organism."

Gnathostatics does not attempt to evade variation but tries to comprehend and understand it. Thus far, it is the only practical method by which orthodontists may evaluate variations, as well as modifications, of the denture and of dentofacial relations. The gnathostatist realizes and appreciates that variation is a way of all life; that there are no absolutely fixed points on the head, face and denture of any individual; that in all probability there never will be any, and hence, there cannot be any natural, fixed, great patterns which "represent the culmination of a gradual evolutionary process, or the unwinding of what is already rolled on the reel of destiny; an unfolding of the leaves of a scroll, and the rendering visible of passages inscribed at the beginning in a secret indelible ink. The introduction of the idea of mutation marks nothing less than a revolution in our scheme of interpretation."

In the words of Simon: "All these undertakings aim at a better understand-

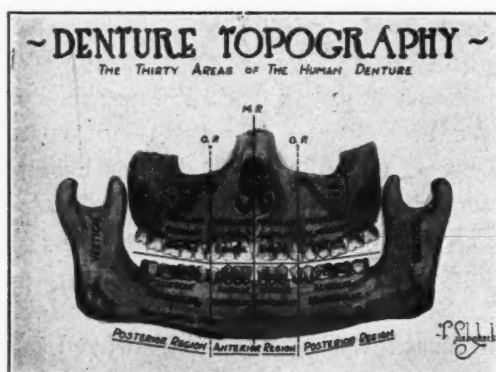


Fig. 9.

ing of the individual, but for obvious reasons they can never be final because the individual will always remain an unknown reality. *The norm is, nevertheless, a necessary and useful fiction.*"

DISCUSSION OF SYMPOSIUM "WHAT ARE THE REQUIREMENTS OF ORTHODONTIC DIAGNOSIS?" BY DR. WAUGH, DR. LEWIS, AND DR. LISCHER

Dr. Harry B. Wright, Philadelphia, Pa.—When Dr. Waugh presented his interesting discussion on diagnosis, in which he kindly gave me credit for the diagram which I showed in Nashville, I thought it might be interesting to give you a little history of how this diagram came into being.

Several years ago, because of the fact that I wished to secure a little more information to enable me to attack this mystery of growth and development, I enlisted as a student in the Medical School, University of Pennsylvania, in a postgraduate class of physiology under Dr. Edward Lodholz. In one of the meetings, a situation arose in regard to growth and development of living things, whether they be human or whether they be plant life. It is a law, recognized by the biologist, that every living thing starts out, from its earliest inception in the living world, to achieve a certain end-pattern, or form of maturity, which this diagram shows.

The earliest conception we have of the new individual is the fertilized cell, but no matter how hard we try, it becomes impossible to predetermine the form of that individual. We may

plant three acorns and get three oak trees, but the end-patterns would be so variable that they may fall within any part of that circle or pattern of maturity. Consequently, when adapted to the human it is just as variable. There are so many mutations and so many variations that one can only say that every individual merely approaches a certain normal in the mature pattern.

After his paper was presented, I spoke to Dr. Lodholz and acquainted him with our problem in orthodontia, and he drew this diagram for me. He claimed at that time, and he was not particularly interested in orthodontics, that in the space between the fertilized cell and the vertical line of birth, we know manifestations of what takes place there are present in the end-pattern, but we know very little of just what takes place. However, what I was particularly interested in as an orthodontist was this period between birth and maturity. He claimed that maturity of the individual, or of the dental mechanism, took place somewhere between eighteen and twenty-five years, and he felt that if such a diagram were used by orthodontists on their treatment card, and if they could determine any obstacle in the path of development, they could make a mark on this line (this line representing years of life). But should this obstacle be allowed to persist, this line would never reach its ultimate achievement but would take a downward path to infinity or malocclusion. If we were to remove the functional obstacle, it therefore followed that the line of development might come again to the normal line and continue on to maturity.

Subsequently in our office we placed that as a fixed diagram on our treatment and examination cards, and we found that a time would come during the observation of an individual, where this line would take a downward path but would again, upon continued observation, without our help, reach the normal line of occlusion, which follows out the work Dr. Lewis has shown us.

We found, however, that after removing the functional obstacle to development and bringing that individual back on a line of occlusion, that that was not the end. It may be, after the third molar presented its appearance, that a new obstacle would present itself, and so on. However, I am sure that if you follow this closely and use it in your own practice it will reveal a great many new things to you that you had not seen before. This end-pattern must be understood as being a variable pattern.

Dr. Martin Snyderman, Pittsburgh, Pa.—After listening to this very fine symposium, upon which all men agreed that we should have facial reproductions and for which the photograph has been recommended, but gives you no particular depth, I wish to submit for your consideration something that I am using in my own office and which all should be able to use in regard to securing definite facial reproductions scientifically accurate.

(Models) When you want a full face, you can have it reproduced but not with plaster, as plaster is difficult to use in making facial casts and is not accurate as far as details are concerned. When we have an orthodontic case, such as is represented here, a photograph will not give detail or depth. I present this model to show what no photograph can give. You may look at it from a profile or full face view.

I shall just show you another model wherein we took a direct impression of a carcinoma of the nose, which is out of the orthodontic line, but which I shall demonstrate for the purpose of showing the possibilities of the materials used. The materials are negacoll, hominit and celerit.

THE COLOR OF THE TEETH AS AN INDEX OF THEIR RESISTANCE TO DECAY*

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THE color of the teeth is an important index of their resistance to decay; it is in fact the principal one that the dental practitioner can use with any degree of certainty.

I shall attempt to show the factors which govern different shades of the teeth, and further to explain to the dental practitioner and the specialist the importance of these variations in planning their cases. Among the latter the orthodontist would find such knowledge of the greatest value.

That the color of the teeth is an index of their strength or weakness in resisting decay has been long known, although in the last thirty years this fact has been almost entirely disregarded. Older practitioners were guided by varying shades of the teeth in judging whether operative procedures should be radical or otherwise. The reason that this factor has been completely neglected of late years is that the cause of decay was considered to be purely environmental, i. e., depending upon the cleanliness of the mouth, on the presence or absence of *Bacillus acidophilus*, or on a change in the chemical constitution of the saliva. The teeth themselves were thought to be entirely neutral or inactive to external destructive agents; the teeth of all persons were regarded as being equally destructible by a mouth acid. Our profession has been obsessed with this idea and has therefore made little progress in the solution of the problem of dental caries. Not only have we advanced comparatively little in the search of the cause of dental decay since the discoveries of Miller, but we have also neglected the more practical phase of the problem, i. e., the prevention of the disease.

Observant practitioners have noticed that individuals highly susceptible to dental caries have teeth of a grayish-white opacity. Yet this observation is rarely taken into consideration when planning the reconstruction of the mouth with fillings, bridges, or dentures. Any restoration or appliance which makes oral hygiene more difficult and favors food retention around the teeth, such as fixed bridges, clasps, or orthodontic appliances, will endanger the teeth in an individual susceptible to dental caries. However, reconstructions are often necessary in just such cases. When they are made, the patient should be warned most emphatically of the increased danger of dental decay. Most practitioners do instruct their patients to pay particular attention to those areas of the teeth covered by clasps; but when a high susceptibility to caries is present, indicated by grayish white teeth, only the most careful oral hygiene by the patient will prevent decay.

The orthodontist can safeguard his work more surely by taking the color of the teeth into consideration. Many children undergoing orthodontic work have little trouble with dental decay, as a result of following the repeated warning to

*Read before the New York Society of Orthodontists, New York City, November 11, 1931.

keep the teeth clean. Some, however, suffer extensive tooth destruction when wearing orthodontic appliances, in spite of an honest attempt to clean the teeth at regular intervals. Parents naturally blame the orthodontist if this takes place, and are not pleased with the end-result. They realize that proper occlusion and a decided improvement in the symmetry of the face have been obtained, but they regret the caries-ravaged teeth. In such cases, it is better for the welfare of the child, as well as for the orthodontist's peace of mind, to refuse treatment in the first place. Patients must be made to realize that dental caries is principally a disease of childhood, and that orthodontic appliances commonly applied at this time will increase this disease in susceptible individuals in direct ratio to the lack of oral hygiene. If the orthodontist has a reliable index as to the probable future activity of dental caries, he can warn and even discourage work for children who show a high susceptibility to this disease. In this way the orthodontist will reduce considerably the number of disappointing cases in his practice.

And now to a consideration of the varying shades of the teeth and the factors which influence them. As already noted, dental caries appears to be particularly active in teeth having a grayish white shade. Persons who are immune or almost immune to dental decay have teeth of a decided yellowish color. The increased activity of this disease takes place when the shade changes from a yellow to a whitish yellow; the "weakest" being those teeth of a grayish white or gray color.

In order to check my clinical impressions on this subject, all the teeth (186) in two jars received from the oral surgery clinic were examined. It was found that 63 were of the yellowish type (Twentieth Century shade guide approximately No. 21) and 123 of the grayish (approximately shade No. 4). These were tabulated as follows:

Total number of teeth examined, 186:

	Grayish	Yellowish
Carious	107	13
Noncarious	16	50
	<hr/> 123	<hr/> 63

These findings indicate that, all things being equal, the yellowish tooth is more resistant to decay. Pioneers in dentistry had this conception; they classed the happy possessors of yellow teeth as a "sanguine" temperament.

Using the color as an index for the variability of the teeth to decay, the dentist can plan his work more methodically, and more nearly insure permanency for his reconstructions. The orthodontist should advise the dentist who treats children with grayish white teeth to have all enamel *fissures* (not grooves) protected by simple fillings; this does not mean that large inlays should be inserted, the placing of which requires great tooth destruction. Cement fillings, preferably of the silicate-oxyposphate type, are sufficient to carry such areas over the time of high susceptibility. The insertion of such fillings requires but little drilling; the highly permeable dentin and the young and very sensitive dental pulp will suffer only slightly. Orthodontic work should be inaugurated with the greatest caution. Parents should be warned most emphatically of the danger of food retention around such susceptible teeth.

Adult patients with grayish white teeth require a more radical cavity extension, in order to prevent redecaý around the fillings. They should visit their dentist every three to four months in order to prevent the enlargement of small cavities with consequent irritation or involvement of the dental pulp.

Little is as yet definitely known of methods for improving the resistance of the teeth to decay. The means at our disposal may be classed as (a) systemic treatment, and (b) local treatment.

(a) Systemic treatment consists of a careful examination of the diet of susceptible individuals. Intensive study of this subject has been undertaken by many investigators. The varying effects of different diets have been studied on animals as well as on children. The consensus of opinion as advanced by Boyd and Drain,¹ Bunting,² Howe,³ Hess and Abramson,⁴ Marshall,⁵ McCollum and Simonds,⁶ Mellanby,⁷ and Price,⁸ is that the diet should contain ample quantities of leafy vegetables, citrous fruits, and milk, and that in some cases cod liver oil and calcium preparations are necessary. The child should have adequate exercise; the intake of carbohydrates should be reduced; candy should be completely excluded, and only a slight amount of sugar should be present in the food. Cereals, particularly those of the highly refined type, from which the coarse cellular envelopes of the grain have been removed, should be excluded. But even a coarser cereal such as oatmeal may be harmful, as children always wish to have two or three heaping teaspoonfuls of sugar with this dish to make it palatable. Sugar should be replaced by the sparing use of salt. If this is done from the beginning, the child will not long for sugar which is most certainly responsible in part for the excessive tooth destruction prevalent in civilized countries.

(b) The local treatment consists principally of stimulating the function of the teeth. This factor is second in importance only to that of scrupulous oral hygiene in reducing the activity of dental decay. The child must be taught to chew energetically, thus stimulating the flow of blood to the teeth and the surrounding gingivæ. This will aid in keeping the mouth in a healthy condition.

Another form of local treatment is the remineralization⁹ of the teeth. This is useful in those patients who have a particularly high susceptibility to dental decay. I believe that this manner of calcifying the teeth while useful, is nevertheless a makeshift, successful only as long as the patient is conscientious in using the powder.

FACTORS AFFECTING THE SHADE OF THE TEETH

The color of the normal tooth appears to be a yellowish white. The factor which changes this yellowish white shade to a grayish white is the varying translucency of the enamel. This tissue under normal conditions has a high degree of translucency, which permits the yellow color of the underlying dentin to become visible, giving the tooth a yellowish white shade (Fig. 1). Teeth of a grayish white shade, on the other hand, have a more nearly opaque enamel, so that the underlying yellow color of the dentin is not visible. The tooth takes on the shade of the grayish white enamel. (Fig. 2.) That this conception of the reason for which shades of the teeth vary, appears to be correct is shown by the fact that the necks of even fairly grayish white teeth show a yellow color. This observation is explained by the decreasing thickness of the enamel as it ap-

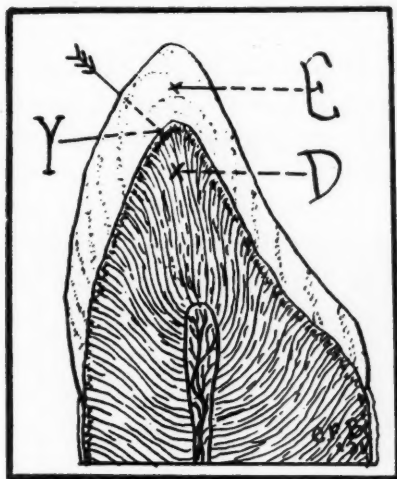


Fig. 1.

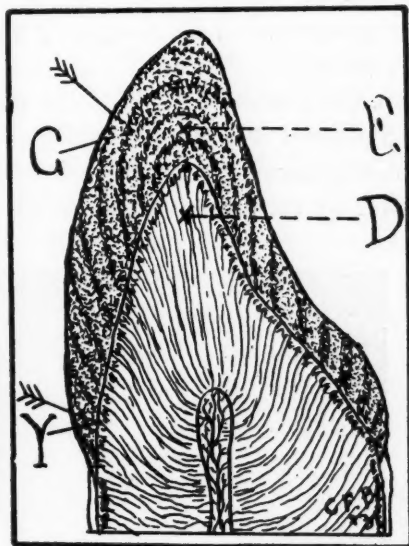


Fig. 2.

Fig. 1.—Diagram of a longitudinal section of a caries immune tooth. The enamel (*E*) is highly translucent and comparatively thin. The light (arrow) penetrates to the yellow dentin (*D*) and is reflected back to the eye of the observer (*Y*); therefore these teeth have a yellow or yellowish white color.

Fig. 2.—Diagram of a longitudinal section of a caries susceptible tooth. The opaque and often thicker enamel (*E*) does not allow the light (arrow) to penetrate to the yellow dentin (*D*) but is reflected back to the eye of the observer (*G*). The tooth therefore takes on the shade of the opaque enamel, that is a gray. At the neck of the tooth, the enamel is thin, consequently the light can penetrate to the dentin and is reflected as yellow; hence these areas have a more yellowish shade.

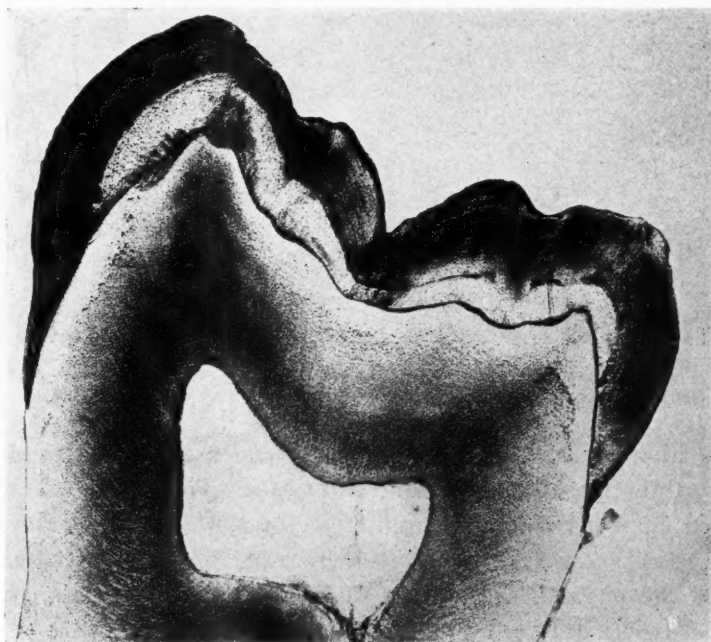


Fig. 3.—Photomicrograph of a ground, longitudinal section of a molar showing extremes of enamel translucency, i. e., highly translucent at the inner margin near the dentin; opaque on the entire surface of the crown. (Enlargement 16 \times .)

proaches the gingival margin. (Fig. 2, Y arrow.) The thinner the enamel becomes, the greater must be its opacity to prevent the yellow color of the dentin from being seen.

The varying translucency of the enamel is noted in Fig. 3, a photomicrograph of a ground section of a molar. Here we note in one tooth two extremes, i. e., the highly translucent enamel near the dentinoenamel border and the opaque enamel covering the entire surface of the crown.

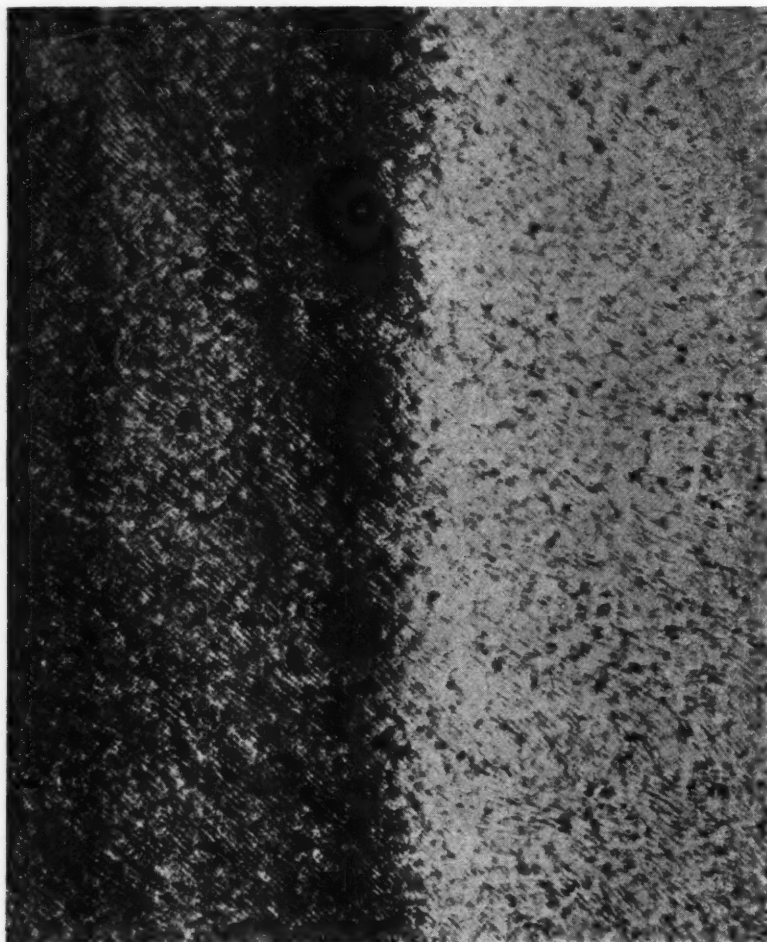


Fig. 4.—A higher enlargement of translucent and opaque enamel. The latter shows more clearly defined enamel rods and striae of Retzius. (Enlargement 200x.)

Fig. 4, a higher enlargement of the translucent and opaque enamel shows the histologic differences between these two types. The opaque enamel has more clearly defined enamel rod sheaths and striae of Retzius; hence the light cannot penetrate so readily. Little is as yet known of the histology and less of the physiology of the enamel, so that we do not comprehend the reason why the opaque enamel reacts differently to dental caries.

Another factor influencing the color of the teeth is the varying thickness of the entire enamel crown in different individuals. That this thickness does vary has been observed in sectioning a great number of teeth for the preparation of

microscopic specimens. Teeth of individuals immune or only slightly susceptible to dental decay usually have a thin enamel crown. Those highly susceptible to this disease show a thick enamel crown with well-developed, or even overdeveloped, cusps, and exceedingly deep grooves. Crowns of teeth with such thick enamel are usually of a whitish or grayish white color, for, as stated, the greater thickness of the enamel makes it impossible to see the yellowish color of the dentin from without. As was also noted, the experience of clinicians shows that such teeth have an increased susceptibility to dental caries. It has been further observed that once the carious process penetrates the dentin through a minute cavity, a great part of the interior of the tooth may be destroyed before the patient or even the dentist notes that dental decay is present.

SUMMARY

1. A knowledge of the probable future activity of dental caries in prospective patients is helpful to the dentist or specialist in planning his work.

2. This information can be obtained for a child or young adult before decay has started by observing the following factors:

3. Teeth of *low caries susceptibility* have: (a) a basic *yellow* shade; the more this changes to white, the more active will decay become; (b) comparatively short crowns of the permanent set, low cusps and shallow grooves; (c) a *comparatively thin enamel*.

4. Teeth of *high caries susceptibility* have: (a) a basic *grayish* shade; (b) comparatively long crowns of the permanent set, high cusps, and deep grooves; (c) a *comparatively thick enamel*.

5. If dental work (orthodontia, fillings, dentures, etc.) is to be done for individuals having the type of teeth described under No. 4, great care must be exercised not to increase the danger of food retention around such caries susceptible teeth.

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DISCUSSION

Dr. Albert W. Crosby, NEW HAVEN, CONN.—All of us have noticed that there are certain things we see in the mouth that indicate a susceptibility to dental decay.

Certainly grayish white teeth do not lead to confidence, but there are teeth of a yellowish cast, which have white lines along the gingiva and sometimes quite plentiful white or brownish areas on the enamel surfaces. I have seen teeth of the so-called bilious type found in people of a square build, arches almost straight across from canine to canine and sides almost straight and parallel, teeth of a color which look as though the possessor had had blueberry pie at the

last meal and who have mouths with very little caries. This pronounced color, however, is not so noticeable in childhood.

There is a sort of sixth sense, sometimes called horse sense, that is very valuable, which is better developed in dentists who have had considerable experience in the general practice of dentistry. It seems too bad that so many young men are going into orthodontia without any experience in general dentistry. I heard of a young medical man who had a good professional preparation but who, immediately after his internship, went into neurology as a specialty. Soon he had a case that did not respond to his treatment. After eight months had elapsed without showing any improvement, he discussed the case with a fine old general practitioner who said, "Bring him over." The boy was duly presented and the old practitioner sized him up, asked a question or two and invited him to remove his shirt. There, sure enough, was as pretty a rosary as one would care to see. "Rickets," said the physician, not chorea.

This example from a parallel field shows that too limited a knowledge of general dentistry may lead us to wrong conclusions in our own field.

As to the evidence brought forward by the essayist, I do not believe it proves anything. If I understand anything about scientific methods, it seems very debatable whether the statements made to corroborate his theory are tenable for the following reasons.

The teeth examined, as I understand it, were gathered at the extraction clinic. Teeth of all sorts—teeth with cavities—teeth lost from pyorrhea, etc., popped into a bottle containing a formaldehyde or alcohol solution, for later examination. Every one who has tried to match a tooth at a dental depot knows how the shade has altered.

One of my friends called my attention to what happens to a highly vascular organ like the liver. It soon turns gray when placed in a solution of either alcohol or formalin.

What do we see in the mouth occasionally? A young patient is brought into the office by a distressed parent. He has been hit with a hockey stick, a ball, or something. Capillaries have ruptured, and the crown of the tooth has a pinkish appearance. If it is not taken care of immediately, the tooth begins to change color.

It is the presence of blood in the tooth dentin which gives the lifelike appearance to the enamel. As soon as the tooth is extracted this natural appearance is lost. So we ask when were the shades taken? Were all the teeth vital when extracted and were there enough examined to establish a "probability ratio"? Should there not be at least one more series as a check-up, if the findings are to be of value? I am afraid the essayist has not made a very good case.

Dr. Charles F. Bodecker (in closing).—In response to Dr. Crosby's doubt as to whether the color of the teeth is the same before and after extraction, I wish to assure him that no perceptible change occurs if they are placed immediately in a 10 per cent solution of formalin. His experience of matching a tooth at a dental depot was doubtlessly with a dried specimen.

Blood as such cannot penetrate the dentin or enamel; only the colorless plasma can do so. The red color of the blood is due to the hemoglobin of the red cells, and these are far too large to enter the dentinal tubules. In a case of severe trauma when a hockey stick or ball strikes a tooth, hemorrhage of the pulp occurs, thus freeing innumerable red blood cells. These break down and then the hemoglobin penetrates the dentinal tubules. This red coloring matter (iron) results first in a pink appearance of the dentin which later disintegrates if not speedily washed out, and causes the tooth to turn dark. The fixing of our specimens on the other hand could not darken them, as no hemoglobin is normally present in the dentin or enamel.

Finally I can only assure Dr. Crosby that I thoroughly agree with his view as to the value of extensive clinical experience in general dentistry. A great deal of my research work is based on thirty-one years of general practice.

A REVIEW OF BRASH ON "CONDITIONS OF GROWTH,
PHYSIOLOGICAL AND PATHOLOGICAL"*

HUGH K. HATFIELD, M.D., D.M.D., BOSTON, MASS.

THE fact that modern science can make an impressive impact upon popular orthodontic concepts is evident in a series of lectures by Professor Brash, delivered under the auspices of and published by the Dental Board of the United Kingdom.

As a contribution to the subject of etiology this volume of Professor Brash, consisting of four lectures, not only offers the most comprehensive review yet made of the literature bearing on the matter, but gives us a new evaluation of the whole present state of orthodontic knowledge. It would be difficult to overestimate its value, and it is certain to win easily the appreciation of those who are convinced of the need of a more reasonable attitude toward our problems.

No chapter in his book is without its challenge to some popular theory, authority or tradition, and it naturally courts criticism. He is, doubtless, no less aware than his critics that he has put to them, and to us all, more questions than he has attempted to answer and is probably content to leave it so. He clearly states that his task was "not to make any premature attempt to demonstrate the origin and causation of irregularities and malocclusion but to examine critically general conclusions which are currently repeated"; to clear the ground so that certain avenues of approach to our problems may be seen more distinctly. This he has done in no indifferent manner. He has given the best of his experience and judgment as a loyal servant of science.

The scientific spirit and aim which characterize this work of Brash do not appear often as conspicuous qualities in much of our literature, and they are not always in evidence at our meetings. Some men seem to turn instinctively from a scientific presentation, as something fantastic and theoretic and unpractical; a statement of fact annoys them; an acknowledgment of ignorance is anathema. The mental attitude of scientific inquiry which distinguishes the leaders in the medical sciences, is in striking contrast with this type of mind.

What is there about *evidence* that makes it so forbidding to some men? Science is simply knowledge established by adequate evidence. "Practical" means capable of applying knowledge to some useful end. "Theory" means the completed result of philosophic induction from experience. There can be no conflict of the true theoretical and the practical, much less of science and practice. "The aims of science are two, and two only," says Professor Giddings, in "The Mighty Medicine." "They are, first, to determine what supposed facts, or alleged facts, or guessed facts, actually *are* facts; and second, how facts are related to one another." Let us take for example, the alleged fact, "that it is always possible to build up the supporting structures of the teeth by physical

*Read before the Southern Society of Orthodontists, October 31, 1932.

force, to harmonize with the design indicated by the forms of the teeth." If repeated attempts and observations prove this to be untrue, and we maintain this conception in the face of this fact, we are neither scientific nor practical, and we make no progress. To not a few men a hundred repetitions of the same blunder constitute "experience," but an interminable trial and error method amounts to very little when we fail to grasp its significance.

At times there is considerable enthusiasm aroused over our rate of progress. It is important to inquire how this rate of progress is to be measured. For an answer to this question, let me quote from the introduction of Professor Brash's lectures. "The progress of medical science is in these days to be measured not so much by mere advances in the treatment of diseases, but by the extent of the knowledge—physiological and pathological—which enables us to substitute a rational for an empirical basis of such treatment. . . . Such knowledge in medical science not only enables us to substitute more effective empirical treatment or to explain on rational grounds the success of well established empirical practice, but also may give us the power to translate into action, the proverbial wisdom, that 'Prevention is better than cure.' "

No one will deny that many earnest investigators have made serious attempts to explain the anomalies we profess to treat. Evidence is not lacking, however, of many abortive attempts, for a mind bred solely on the mechanics of tooth movement is not likely to see far beyond mechanical principles, and these will not suffice. A mind untrained in scientific reasoning yields easily to the assumption that what is believed by many must be true, merely because of its wide acceptance. The Hindus believed the foundations of earth were supported on the back of an elephant, but this was not true.

No thoughtful orthodontist can survey our history and literature today without feeling that we are repeating in a strikingly similar way, the history and experiences of medicine. Medicine emerged from a period in which "there did not exist a well-founded universal scientific method of thought, investigation or teaching, but only opposed and battling 'schools and systems' of medicine and therapy." When the specialty of orthodontia finally shakes itself loose of the restricting bonds of a mechanical "cult" which kills the very spirit it should embody, when it arouses itself from its narrow views and "exclusive" endeavors and allies itself whole-heartedly with the biological sciences, *adopting their methods*, then its place in the field of science will be more secure.

The indications that such a change is taking place are very real. One of the unmistakable signs of a different habit of mind which is working to produce a revolution in orthodontic thought is the notable change in the attitude toward authority. Brash has shown that our questions and disputes are not to be settled merely by quoting words spoken by some individual or statements from some book. Words have not the value of authority which they formerly had. No matter who speaks the words or in what document they are placed, it is the custom today to penetrate beyond the statements to the ideas which brought them forth. There is no hesitation today in asking any one such questions as "How have you reached these conclusions?" or "What is the basis in fact for your statement?" This is the attitude of mind and spirit in which Professor Brash

has undertaken to review the whole present state of our orthodontic knowledge, and we may readily infer from the following remark that there was no question in his mind of the necessity for doing so when he says, "the reading and sifting of opinions and counter-opinions has left a clear impression on my mind that very little *positive* evidence has ever been adduced in support of the many supposed causes of irregularities and malocclusion."

For a discussion of this problem of etiology, the author considers it reasonable to ignore the obviously "incidental" or "accidental" happenings to the jaws which may result in malocclusion, such as excess and defect in teeth, extraction, artificially applied force (comparable to artificial deformity of other parts of the skeleton), as in habits of certain kinds, and other purely local causes. The varieties not falling under these heads provide the main discussion.

Professor Brash will find many to agree with him, that the prevalence of such irregularities and malocclusions, at least in modern times, suggests some deep-seated cause. He says, "the evidence of the incidence and distribution *alone* seems to point to racial and individual inheritance as important factors." In consideration of this view, the author spreads out an evolutionary background to the problem, and discusses the general aspects of its nature; then follows an analysis of such general questions as variation, disharmonies, heredity, and certain aspects of the growth of the jaws. In lecture II, the importance of the bearing of these factors on the problem is emphasized, but it is made equally clear, so far as satisfactory conclusions on the inheritance of malocclusion is concerned, that the necessary data are simply not available. He thinks, however, a provisional hypothesis is permissible at this stage, which he frames as follows: "that irregularities and malocclusion are in a broad sense, inherited conditions, that there are many points in the evidence of incidence and distribution that seem more consistent with nature than with nurture."

In lecture III, the part chosen to review at this meeting, the discussion is directed to the field of environmental action, and the impression might be gained here that the subject of etiology could be divided into two parts, or that "nature" was pitted against "nurture." For his immediate purposes this is convenient, but when he describes the conditions of each part, we cannot help feeling that he makes them too exclusive. However, all objections are overruled when he states, that "All nurtural factors must primarily be considered as the compliment of the inheritance . . . that physiological factors which may appear to condition and to control the growth of the jaws may themselves be the expression of the genetic constitution . . . and that in any case, environmental and nurtural influences have *very varied material* to work upon."

This field of environmental action has supplied most of the ammunition for controversial fire in the past but appears to have brought down very little in the way of real evidence. Chief among the conditions discussed is the amount and quality of the food supply: the deficiencies and faults in nutrition, a subject which offers the most intriguing opportunities for speculation. There can be no doubt that nutrition holds an important place, perhaps first place, in judging the physical status of children. Many comprehensive investigations in this field have been carried out by various health agencies. A recent report estimates

that six million of our forty-five million children are undernourished when judged by the relation of weight to age and height. At the same time many observers find it difficult to accept this report unless one accepts also one type of body build as normal for the whole nation. They point out the inadequacy of such measurements when applied to our population, which is so blended and conglomerate in nature. Can one type of body build be normal for the whole nation? We might point to our own experiences with the fallacy of endeavoring to establish occlusion and arch form on the basis of the American Indian.

Is one form of occlusal relations and arch form normal for all children? How can it be?

The importance of the "accessory" factors or vitamins in their relation to proper growth and nutrition has been established beyond doubt. The part certain of them have played in the solution of some of the so-called "deficiency diseases," beriberi, scurvy, rickets, etc., is known to many, and the newer knowledge of nutrition has been broadcast. It is perhaps the rare child who gets no orange juice, cod liver oil or sunburn. Professor Brash urges particular need for caution, "in view of the special relation of certain of these factors to growth in general, and the growth and structure of bone in particular, and the strong tendency in many quarters to make them responsible for variation in the bones of the face." He asks for the *evidence* of their relation to the jaws.

McCollom and many other investigators at various times have commented on the widespread prevalence of faulty nutrition among children of this country and in Europe, which has resulted in faulty bone growth, teeth and posture. Narrow jaws and crowded teeth have often been included in the lists of "degenerative defects," on the assumption that they too were indications of general malnutrition. But, says Brash, "apart from the fact that the skeleton is the last part to suffer in general undernutrition, as in starvation . . . the evidence is lacking that general defects of nutrition have any selective action on the jaws; and the mere fact that poor physique and malocclusion are both prevalent, is no argument that they are due to the same cause." In view of the evidence that the growth of the alveolar arches and the eruption of the teeth are parts of the same process, Brash finds it difficult to suppose that defects in general nutrition would have a selective action on the jaws by causing general smallness or alteration in their mode of growth, without at the same time altering the growth and eruption of the teeth to a corresponding degree.

Those of us who were fortunate enough to attend the meeting of American Society of Orthodontists at Atlantic City in 1921, will recall the remarkable report Friel made on the condition of the children of Vienna in 1920, following the war. Brash expresses the opinion that it provides a strong probability that general malnutrition is not an important etiologic factor. There was at that time, as is well known, a great amount of scurvy and an increase in the incidence and severity of rickets; yet Friel found no maldevelopment of the jaws in the children under six years, and malocclusion was not so common as in England. In 1930, at Nashville, Professor Mendel presented a paper on the subject of "Nutrition and Growth" (which, by the way, has never been published), and the conservative tone of his remarks was impressive. Illustrations of accelera-

tion and retardation of growth were shown. Some of particular interest were animals which appear to be "marking time," as a result of certain vitamin-deficient diets. To all appearances the animal is thriving and normal, and the external and general features are unchanged. Dr. Mendel said that almost nothing was known about the intimate structure and histology of the organs under these conditions, although something is known of chemical composition. Experience in the study of the processes of nutrition leads to the inference that for the most part the various tissues and organs will assume and retain their normal chemical composition and fundamental morphologic structure quite regardless of the rate of their development. The "law of the minimum" comes into play in the sense that, among the substances nutritionally essential to growth, the one furnished to the organism in minimum amount (relative to the need for growth, at a normal rate) will thereby determine the rate of growth, the organism growing only to the extent to which it can increase its size and at the same time maintain the normal composition of its kind. This means that organs and organisms as a whole may tend to "mark time" in their growth whenever there is a relative shortage of some essential in nutrition.

Referring to the well known work of Mellanby, who, by the way, has been chiefly concerned with tooth structure and has been getting irregularities incidentally, Brash feels that the condition found in these experimental animals is definitely pathologic, and of a severity extremely rare in human jaws. Furthermore, this crowding and irregularity of the incisor teeth which Mellanby noted, is not an uncommon thing in domestic dogs. Experimental work, such as that of Mellanby's on puppies, shows that deficiencies in certain vitamins produce a very definite and recognizable pathologic picture, but it has not shown that they have any effect in altering the form of the jaws.

The condition produced shows alterations in the structure of the bone, and irregular eruption of the teeth, with consequent disturbances in arrangement; but, says Brash, "it is not likely on general grounds, to stand in any close relation to irregularities and malocclusion because of the absence of evidence that actual deficiency capable of producing these results is widespread." "Apart altogether from the fact that such a condition of the bone and of the teeth is extremely rare in the human jaws, if we grant that the structure of the teeth may furnish some index of the deficiency of vitamin D, with due regard to other factors such as the calcium-phosphorus balance, and excess of 'anticalcifying substances,' then apart altogether from clinically recognizable rickets, there ought to be some parallel incidence of hypoplasia and irregular position of the teeth. That [says Brash], so far as I know, has not been shown to be the case."

He thinks that Howe's "scorbutic and rachitic monkeys" show conditions similar to the osteomalacia observed in animals kept in confinement in zoological gardens, and fed on muscle meat instead of blood and glandular organs, their natural food. Scurvy has now almost disappeared in this country, Mendel says.

The incipient stages of malnutrition are obviously the ones of interest to the orthodontist, as it is not likely that the graver forms are frequently seen in our daily practice.

In young animals the interruption of growth is one of the earliest signs of practically every type of deficiency.

It does not appear, however, that an interruption of growth or a disturbance of structure necessarily means a disturbance of form. All experimental evidence so far at hand points to the specific influence of vitamin D on the calcium and phosphorus metabolism of the animal organism, and the importance of the properly balanced relationship of the two. These principal inorganic constituents of bone, are carried in the blood plasma, and according to a theory advanced by Howland and Kramer these substances diffuse into the interstitial spaces when they arrive in the osteoid tissue. In rickets the adequate precipitation of calcium salts fails to take place.

Experimental evidence seems also to show a definite and direct relationship between vitamin D and the structure of the teeth; it appears not only essential to their proper development but also as an important factor in building up the resistance of the tooth and preventing caries or checking its spread. Brash devotes considerable space to the discussion of this question of rickets, in view of the prominence given in the literature of its assumed etiologic significance, and of the more important matter, the close relation of vitamin A and vitamin D to growth and the calcification of the skeleton. Rickets, as a disorder of calcium and phosphorus metabolism, makes a hypothesis of its casual relation to deformities of the jaws very obvious and attractive, but there seems to be little evidence to support it. Certain forms and characteristics in the jaws have been described, and rickets has been held responsible by various writers, but as these same characteristics are frequently not found in the jaws of rachitic children and are as frequently present in those who do not suffer from rickets, as judged by other and usual signs, the idea is not convincing. It is probably true that any tendency to believe that rickets may be responsible for deformities of the jaws is due to the idea that such deformities might be produced by a bending of the jaws, on the analogy of the deformities of the limb bones; but bowlegs and knock-knees are due, not so much to muscular action, but largely to the weight of the body on the disordered growth areas; the conditions surrounding the jaws are therefore not comparable; furthermore, there is a pretty general weakness of all the muscles in rickets.

He concludes that "it is entirely speculative and very probably untrue to assume that irregularities and malocclusion may be due to a lack of vitamin D, or any other vitamin, which is not sufficient to produce those general signs which are, in fact, the experimental evidence of vitamins."

Professor Sherman of Columbia¹ stresses the importance of calcium intake and says, "Probably a large proportion of the ordinary dietaries, both of adults and of children, can be improved by enrichment in calcium than in any other one chemical element. It is better to speak of the benefits of enrichment than of the dangers of deficiency, because deficiency seems to be a somewhat ambiguous term, whereas the benefit of a liberal intake of calcium is a matter of more positive knowledge to all who will study the experimental evidence. It is an important fact, perhaps too often overlooked, that children who are growing normally in height and weight often have bodies which are more or less calcium poor, with nothing to reveal this condition even on the most careful and searching physical examination. Obviously, the direct further study of this point by

chemical analysis of the body to determine its calcium content at different stages of its growth on different calcium intakes cannot be done on children themselves. When one has recourse to this sort of experimentation on the rat, it is found, as shown by Sherman and MacLeod and by the still more recent work of Booher, that the calcium-poor condition of body may continue, with no outward sign to reveal it, throughout the whole growing period.

If it be asked just what penalty ensues from such a calcium poor condition of the body, the answer is not altogether clear-cut; the condition described probably plays a part in a number of weaknesses and increased susceptibilities to infection without being exclusively responsible for any one of them. The interrelationships of nutritional factors will have the effect, on the one hand, of a divided responsibility for many suboptimal conditions, so that these while really nutritional cannot readily be proved so. On the other hand, however, it makes possible the attainment of highly significant improvements in the general condition of nutrition through the joint effects of the interrelated factors."

In the early days of nutritional investigation, there was considerable concern over the tendency to substitute artificial for the natural feeding of infants; and many positive pronouncements were made on the question whether a resulting malnutrition might be responsible for malocclusion. Professor Brash thinks a discussion of this question is perhaps a little out of date, but he reviews the matter briefly and injects a few clarifying remarks to show that no correlation has ever been shown to exist between artificial feeding as such and malocclusion. First, the functional and mechanical aspects of sucking and their supposed evil effects must be clearly distinguished from the nutritional aspect of the question. Then, it seems to have been overlooked that breast-feeding as such is no guarantee of adequate nutrition of the child, for suckling may be continued where there is a deficiency of breast milk and the milk itself may be deficient in constituents or in vitamin content. Statistical statements of the distribution of malocclusion in "breast-fed" and "bottle-fed" children, he says "are valueless, unless we know the distribution of breast-fed and bottle-fed children in the population from which the examples are drawn. It seems to be a very elementary proposition that more malocclusions will be found in bottle-fed children if these outnumber the breast-fed, as doubtless they do in many populations."

Various attempts to find a direct connection between illnesses and malocclusion, the author says, have led to no results of value as yet. Opinions are usually based upon an association which arises from a high incidence of both.

The establishment of antenatal clinics indicates the tendency today to carry investigations back to the child's start in life. Doubtless, the most important thing we do in life is to choose our parents, as Professor Crew says, but aside from genetic constitution, the environmental conditions of development offer a wide and largely unexplored field. Fetal variations we know occur, and the probability of widespread deficiencies in nutrition suggests antenatal influences, but we are in complete ignorance of details as far as the jaws are concerned, and nothing more than one or two general points are suggested. "When general conditions of nutrition are adverse, it is the mother who suffers, and not the child."

Investigations of Booher and Hansmann² show that with respect to the depo-

sition of the inorganic constituents of the bones, the normal human fetus may be regarded as entirely parasitic on the maternal organism, since large differences in calcium and phosphorus intake did not effect the degree of calcification in newborn infants.

Professor Brash is not vastly impressed by Murk Jansen's well known phrase "feebleness of growth." He says, "it is quite certain that an explanation of jaw deformities by attributing them to an assumed 'feebleness of growth' in the individual is no explanation, and cannot satisfy us from the etiologic point of view." It is very evident, however, that nature cannot always guarantee a safe passage through intrauterine life, without detrimental influences, remarkable as this protective adaptation usually is. Toxic conditions in the mother, diseased placenta, and Stockard mentions particularly faulty connection between the maternal and fetal circulations, may result in feeble children being born. Yet we do not know that these feeble children are more liable than others to have malocclusion.

There is, however, considerable evidence from Schultz's work on fetal conditions to show a high intrinsic general variability in the embryo, and Brash quotes him as stating that the tendency now is to consider that the influence of the developmental environment cannot be large, and is often overstated. Schultz has something to say on "the opinion advanced by Weinberger that the fetal positions may be abnormal and caused by or the result of mechanical disturbances, such as amnion pressure." Schultz says, "Intrauterine pressure of one sort or another has been held responsible for a variety of embryonic conditions, but critical studies on large series of specimens have invariably failed to confirm such contentions."

Among the several diseases in which disturbances of bone growth occur, one gets special mention, viz., achondroplasia. In this condition the defect is at the base of the skull, which remains very short; the growth of the facial bones and the palate has to proceed from this shortened base between the enlarging cranial vault and the growing mandible, which is less affected. The palate is flattened and spread out, providing insufficient room for the teeth. Brash finds no evidence that mild degrees of achondroplasia can be held responsible, in the absence of any other evidence of that condition, for any form of malocclusion.

Chief among the conditions of growth must be reckoned the internal secretions; and with their consideration the chapter closes. There has been much discussion of their influence on the facial skeleton and thus secondarily on the position of the teeth, and as in the case of vitamins, "there has been a tendency for speculation to outrun knowledge." Again we witness the author's determination never to step beyond the pale of clear evidence or to venture into the realm of theory and speculation. He recognizes the very considerable body of detailed knowledge of the relation of these glands and hormones to skeleton development and of certain of them to the development of the bones of the face in particular, but "in the absence of the characteristic and obvious effects of aberrations of their functions," he does not think the evidence warrants the assumption that there may still be a whole range of variations due to variations in their secretions. In other words, the outspoken nature of the changes in acromegaly is manifested

in giantism; in cretinism we get an individual dwarfed in size; can minor variations in the secretions bring about jaw disturbances without manifesting these striking general bodily signs? Brash thinks it improbable.

Continuing, he says, "The very brief statement I have made on the relation of the secretions of the ductless glands to growth in general, and the growth of the skeleton in particular, is perhaps sufficient to indicate that the proper development and growth of the facial bones, and therefore the normal eruption and alignment of the teeth, must incidentally be conditioned by their correct functioning as a whole. So much every one will allow. But the explanation of individual examples of malocclusion, as a local result of some aberration of the function of one or other of these internally secreting glands, is a very different matter. For I think it can hardly be maintained that there is any evidence for such an explanation on the basis of deficiency or excess of any hormone in those individuals, constituting the vast majority of all cases of malocclusion, in whom other and general signs and symptoms of such deficiency or excess are not to be found. In other words, interference with normal facial growth, and with the normal eruption and alignment of the teeth leading to irregularity and malocclusion which can be with any confidence assigned to hormone disturbance, is always found as part of a general condition upon which the diagnosis must rest."

"Vitamins and hormones have a special relation to growth in general and to the growth of the skeleton in particular. It is undoubted that deficiencies of vitamins sufficient to produce a pathologic condition of bone, alterations in the function of internally secreting glands sufficient to produce clinically recognizable signs and symptoms, and other general disorders of growth, of unknown origin but often strongly hereditary, may all be accompanied by changes in the facial bones with incidental irregularities and malocclusion of the teeth. There is, however, no evidence in support of speculative opinions that common irregularities and malocclusion may be due to such causes in the absence of other characteristic signs. To such speculation, which one cannot deny may contain some truth, there is from the point of view of stating the present position of knowledge only one answer—we do not know." Thus, he leaves the question open and in no sense inconsistent with his provisional hypothesis, when he says, "the ductless glands and their mode of functioning are subject to the laws of inheritance, and the determining hormone balance which gives expression to various physical and mental characteristics may be itself genetically determined." Widely exploited as no doubt this endocrine field has been, the great importance of endocrine glands in controlling development is arousing unusual scientific interest and at the same time has opened up the important issue as to what part heredity plays in it. At a meeting of the American Society of Orthodontists held in Buffalo in 1928, Dr. C. C. Howard reported his work on endocrine function and skeletal development. This seems to have been the first attempt, on such an extensive scale, to correlate conditions of malocclusion with developmental conditions in other parts of the body. Very little recognition was given this work at that time, but its significance today is becoming more and more evident, and in the future I believe will be noted as a valuable contribution to the etiology of malocclusion. One of the most interesting experimental investigations in genetics taking place in

America today is Professor Stockard's work on dogs at the Cornell Experimental Farm. Dr. LeRoy Johnson will present the material he has gathered from this important field.

It has appeared to many of those who have worked conscientiously to make the most of our very meager etiologic equipment, in order to grapple with the complexities of the malocclusion problem, that the dawn has already begun to whiten the sky. It is not at all disturbing to the hopes of such eager observers that Professor Brash has found so little positive evidence in support of the many supposed causes of irregularities and malocclusion; the sharp emphasis he puts upon scientific data brightens the outlook; and the incisive logic with which he strikes at certain common assumptions clears the orthodontic atmosphere of much that has befogged our horizon. The problems orthodontia presents are fundamentally biologic ones, and quite as fascinating as can be found in any field, and it is perhaps this very fascination which has evoked the speculative propensities of those who are oblivious of the dictum: "Medicine owes no thanks to him who, without proof, would formulate her theories."

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DISCUSSION

Dr. George R. Moore, Ann Arbor, Mich.—In opening the discussion of Dr. Hatfield's paper I feel somewhat handicapped in not having had the opportunity of reading it in advance. I cannot therefore adhere to what is usually expected of discussors. My remarks will have to be confined for the most part to a brief account of my own reactions to Brash's work itself as I read it.

The book is from cover to cover a citation of negative evidence designed to disprove commonly accepted views concerning etiology. It is like many novels. Read the first few dozen pages, and the remainder is an open book. Conclusions are easily predicted. Not one of Brash's problem cases yields a positive correlation. All is negative evidence which he collects and passes on to the reader.

The effect is rather deadening and even discouraging at times. The clinical orthodontist sees one after another of his pet theories, such as those relating to diet, endocrines, masticatory function, habits, and mouth-breathing, obscured by the application of a devastating logic. Yet none of Brash's conclusions are hastily drawn, and very few could be refuted in the light of present knowledge.

Unless I misinterpret his views on vitamins and hormones, however, there is good reason to modify his assertions. He says for example, that, "There is no evidence in support of speculative opinions that (common) irregularities and malocclusions may be due to vitamins and hormones in the absence of other characteristic signs."

At variance with this viewpoint, Sir Arthur Keith instances those curious cases of hemihypertrophy of the jaws in children, which are occasionally seen, and suggests that these should be regarded as localized forms of acromegaly, due to a disturbance of the hormone machinery which lies behind generalized acromegaly. In Keith's own words, "The anatomic elements of a single functional unit are picked out." If Keith's reports are correct, there is evidence refuting Brash's assumption that hormones have no selective action on the jaws in the absence of other characteristic signs. I hope to hear other modifications of Brash's viewpoint in the general discussion which follows:

Brash's work merely brings to a climax the views of Johnson, Hatfield, Hellman and others who have been telling us for years that very little is known about our fundamental orthodontic problems.

Hellman said in 1922 that "When put to the test not one of the recommended factors is found to bear any definite relationship to a particular form of malocclusion." He also goes on to say that "Most of these factors of malocclusion accepted by modern orthodontists have come down to us by tradition, and are accepted on no other grounds but by the recommendations of some authority."

In orthodontia, as in any other science, truth comes only with time. The field is still young. Its first advances must be negative. It must creep before it can walk. But rather than be discouraged by the weight of negative evidence, we should be spurred on to greater effort. Brash himself suggests heredity rather than environment as the hypothesis which should dominate future discussions and investigations in our field. Our next task is to bring ourselves to realize how really fundamental our problems are, and to put promising research men to work on them.

Today there are indications of progress along this line. With graduate opportunities opening up in several grade A dental and medical schools, the future undoubtedly holds much in store for the profession in the solution of basic problems.

Dr. Hatfield (in closing).—Dr. Waugh may have created a misunderstanding of Professor Brash's point of view, when he reminded us not to forget environmental factors. Brash does not forget environmental factors; he says, "consider heredity as carefully as you have environment." Finding a dearth of evidence in our literature in a consideration of one phase of development, he simply advises us to look at the other "as well." If Dr. Hellman's remarks refer to processes of development, that is not within the scope of Brash's criticism. Brash was in search of initial factors responsible for malocclusion, not the way malocclusion may evolve from unknown factors. I am fairly familiar with the literature and have no reason to modify the idea presented this morning. A paragraph on page 16 makes this clear: "Lastly, I would point out that the mode of production of deformities of the jaws is not to be confused with their etiology. The investigation of the ways in which the mechanism of the growth of the jaws may be altered in the production of special varieties of irregularities and malocclusion no doubt has an important bearing upon their etiology, but it is not within my province in these lectures."

A DISCUSSION OF THE CLINIC PLAN AS APPLIED TO ORTHODONTIA

W. R. DINHAM, D.M.D., SEATTLE, WASH.

DUE TO the present day agitation for group practice, etc., as well as the recommendations submitted to the professions of medicine and dentistry by the Committee on the Cost of Medical Care, I have been invited to relate our experiences in extending our services to families with smaller incomes than we were able to serve in our private practice. We felt that if we could put into effect a plan whereby many duties now performed by orthodontists conducting a private practice could be delegated to others, the cost of orthodontia would be reduced. With this thought in mind, Dr. Paul D. Lewis, my associate, and I established an orthodontic clinic and carried it on in conjunction with our private practice. All clinic patients were required to present themselves for treatment during school hours, thus we could utilize the time which is usually not so valuable in a private practice.

In September, 1929, our clinic was opened, one month prior to the eventful October crash. Unemployment, reduction of wages and all the ills attendant thereto, as well as the uncertainty regarding the immediate improvement in business conditions, followed this collapse and gradually diminished the demand for orthodontic service to that group we hoped to serve through our clinic plan. We continued the operation of this service, however, for two years following the crash but finally concluded to close the clinic until conditions became more stabilized.

It is unnecessary to dwell upon the fact that even when times are normal orthodontic service provided under the usual method is beyond the reach of a very large percentage of families. In order to make orthodontic service available to all, the responsibility would have to fall on *public or endowed institutions*; therefore, the operation of a clinic is primarily to make orthodontia available to families who come within the lower income brackets, which group cannot afford to pay the usual private practice fees.

In order that a clinic can be operated with a maximum degree of efficiency much thought must be given to office arrangement and organization. Then, the assignment of various duties to others trained to perform them equally as well will eliminate everything but the essentials, such as diagnosis and treatment, for the orthodontist.

Let us assume that the clinic idea is in accord with sound business principles and will accomplish its objective, namely, the rendering of orthodontic services at a fee within the reach of more families. Then, going further, it must be sufficiently remunerative to those engaged in the operation of the clinic in order that the same conscientious service be rendered as in a private practice.

I am convinced that the clinic should be conducted by two or more orthodontists operating on a cooperative basis, for the responsibility attached to such

an undertaking is too great to be assumed by one man. This provision also insures, to a greater extent, those under treatment of the supervision of an experienced orthodontist at all times even when due to any cause such as illness, etc., it is necessary for one to be absent from the office.

Some may be of the opinion that a group of orthodontists devoting a certain portion of their time each week, practicing in some centralized clinic could answer the purpose equally as well, but I feel that such a plan would not be workable. First, because in the practice of orthodontia, unlike the general practice of dentistry or medicine, even the question of diagnosis is not a matter of common agreement as yet; second, there is no uniformity of the appliances to be used, some prefer one type and others something entirely different; third, while the same end-result may be desired by all, the step-by-step procedure in treatment is a matter of choice. Then, too, it is necessary to have a certain definite authority in order to settle questions which otherwise might cause disagreements and friction; so all in all, this plan seems practically impossible.

Let us now consider the help problem connected with the clinic plan. An able technician is of the utmost importance. He must be trained by the orthodontist, and we have learned from experience that this takes considerable time. Soldering technic and appliance construction require much practice, and as he has not had the advantage of a college training, a knowledge of tooth form, etc., must be taught to him. We have found that the indirect method of band making is very accurate, especially for molar bands. The orthodontist can save a great deal of time as well as make it more pleasant for the patient when band making and other construction work are done from impressions. A skilled technician working in the laboratory all of the time can, I believe, take care of this part of the work very satisfactorily.

Prophylaxis in orthodontia is recognized as being of the utmost importance, and a dental hygienist can assume this responsibility, teaching the patient the correct method of brushing the teeth and instituting regular office prophylaxis. Instruction in developmental exercises as well as advice along nutritional lines can also be part of her duties. A capable hygienist can save the orthodontist much time as well as render the same service perhaps better than he would, because this particular phase is her own responsibility and she is not burdened with many other duties.

A capable secretary is necessary to take charge of all case records and financial arrangements; she can also check materials and supplies, disburse funds, and see to the collection of accounts, thereby reducing to the minimum loss from these sources.

It is also necessary to make provisions for additional operators from time to time, and this problem is no doubt the hardest one with which we have to cope. Most of us believe that the man specializing in orthodontia should have had some previous experience in general practice; therefore, the operators in the clinic must necessarily be men who are giving up a general practice to enter the specialty. Many are married and have obligations that make it prohibitive for them to attend college postgraduate courses for a year. If they have been able to take advantage of one of these courses, they immediately settle down to build their own practice, feeling that their training is sufficient.

There is a natural reluctance on the part of one after his postgraduate work to assume even part time duties under the direction of an orthodontist in the same community; for this reason it is often impossible to obtain the services of trained men. So, the only alternative afforded us in obtaining operators for the clinic is to find men in general dentistry who would be willing to come into the office for the purpose of learning and to earn a sufficient amount to tide them over until such a time when they can go into practice for themselves. This source is very limited, however, as it must be confined to men in our own community; for those outside the state would hesitate to prepare for a state board examination, which would be necessary in order for them to practice in the clinic even under the orthodontist's supervision. This procedure is unnecessary in medicine, as many hospitals and institutions other than colleges offer opportunities for internship and postgraduate work without a state license. Perhaps if state dentistry should ever become a reality, departments in orthodontia would exist; then it may not be necessary to pass a state board examination. Such a situation we know exists in the federal government's dispensation of dentistry needed by patients in veterans' hospitals, etc.

In the operation of a clinic, men untrained in orthodontia may be called liabilities for the first few months, and unless they remain long enough to become assets there would be no object in having them. I feel that they should be attached to the clinic at least two years in order to make it worth while training them.

One plan to offset the cost of training the operators would be to charge them a tuition fee for their preliminary training, which could be deducted from the salary paid to them when they become proficient enough to undertake treatment under supervision. We have not tried out this plan, but nevertheless it offers a solution to this help problem as well as making it possible for some men to procure orthodontic training who could not obtain it otherwise. The number of operators necessary would be so few that they could be highly selective.

The motive back of such a plan would not be to conduct a school but to reduce the cost of efficient help in order to pass this saving on to the patients. Although I do not wish to minimize the necessity of able technicians or the value of capable hygienists, assistants, etc., still the ultimate success of the whole clinic must depend upon those who actually render the orthodontic treatment. Therefore, the selection and the training of operators are of vital importance.

If it were possible to obtain college trained orthodontists who would be willing to work harmoniously under the direction of those conducting the clinic at a salary within its financial limitations, I believe this would be ideal; but for the reasons previously stated this seems impossible, and some other plan must be evolved to acquire this necessary trained help.

Let us next consider the rental overhead expense. Exclusive medical-dental buildings have many advantages because of the service they can render their tenants, but on the other hand the floor space rentals are too costly for a clinic, and the location of such a building is not the incentive of those applying for treatment. The character of treatment rendered and its cost are the predominant factors influencing the prospective patient, and I believe the selection of a location away from the high rent area will serve equally as well, and a great saving

in rent can be made. College clinics have proved that it is unnecessary to be in the very heart of the city to obtain patients.

The fees an orthodontist cares to charge for his services are purely a personal nature, but many times low fee inducements will bring a volume practice which often results in a service not even worth the low fee asked. This may be due

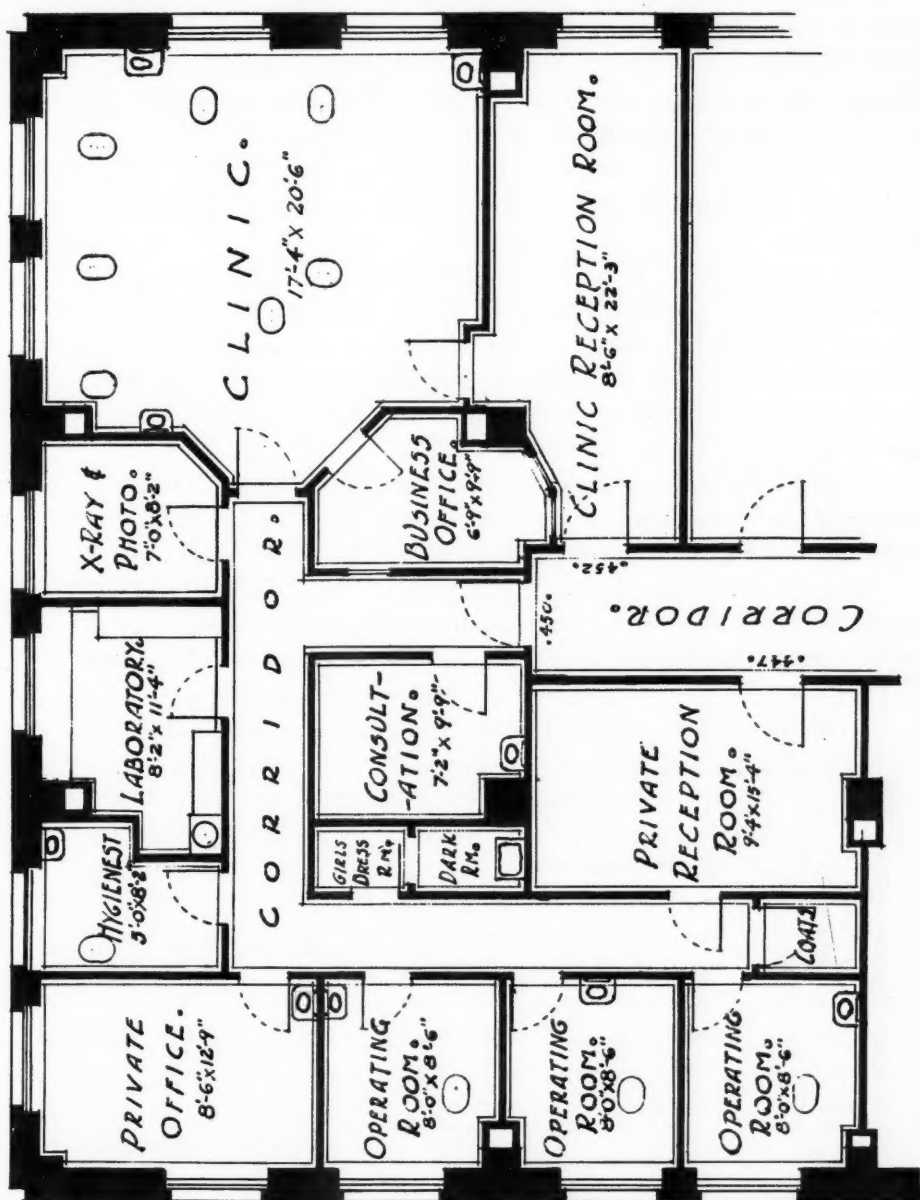


Fig. 1.

not to the orthodontist's lack of knowledge, but to his inability to handle the volume he has thus acquired. It would seem, therefore, that the clinic plan offers the best medium for properly taking care of a volume practice. Properly operated it can fill a very important and necessary part in the economic problem of extending service to more families, but it is beset with many problems and

difficulties, and this field of practice should not be entered without a very thorough and careful preliminary study of all factors.

During these times of financial stress and the falling off of practices throughout the entire country, efforts may be made by some to combat this condition, believing that if they operated a clinic all would be well, but there is a grave danger in having such a movement run wild. In order to control such a situation I believe it would be well to encourage those about to engage in a clinic practice to obtain the approval of their sectional orthodontic society, and in addition a certificate from the American Board of Orthodontia should carry much weight as to the orthodontist's qualifications, etc. Although I have not as yet presented myself for examination before the Board, still I feel that its influence can do much toward putting the stamp of approval on those about to engage in a clinic practice.

I wish to state that I believe a clinic operated in the manner previously described is a step in the right direction in making orthodontia available to many who are now discouraged from attempting to obtain this most valuable service because of its cost, and I know from our experience that equally as good a service can be rendered in this manner of practice as can be supplied in a private practice.

In closing let me call attention to the statements made by Dr. C. E. Rudolph, a member of the Committee on the Cost of Medical Care, in his splendid article published in the January issue of the *Dental Survey*, a paragraph of which follows: "Make no mistake; the public is going to get what it wants. The value of health has become one of paramount importance to the public and the studies of our committee have been most valuable in focusing public attention on the fact that there is a way of providing medical care for people who are not getting it now. I do not see that the extension of the market for medical services dispensed in groups in any way closes the market for medical services dispensed by individuals. Nor do I think, purely from the point of view of the professions, that it will lessen the market for the individual physician's or dentist's services."

ADJUNCTS OF THE NEW ANGLE MECHANISM*

RICHARD LOWY, D.D.S., NEWARK, N. J.

THE construction, application, and dynamics of this appliance have been thoroughly discussed by other writers. The main purpose of this clinic is to present a few adjuncts which we have used successfully.

Fig. 1 shows the method used by means of which stainless steel arches can replace the 0.018, 0.020, and 0.022 round gold platinum arch wire. A round tube soldered to a small piece of 22 by 28 edgewise arch wire forms a bushing, which in turn acts as a stop or spur when the round wipla arch wire is inserted. This is particularly applicable when a protraction is desired. If additional force is

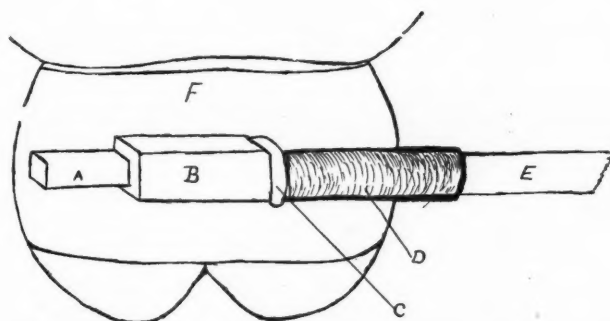


Fig. 1.—A, 22 by 28 gold platinum arch end soldered to round tube (D); B, buccal tube; C, washers for extending the arch; D, round tube into which E Wipla arch is inserted; E, round tempered stainless steel arch, 0.022; F, molar band.

needed, it is only necessary to place a washer or washers on the 22 by 28 arch wire between the buccal tube and the round bushing (D).

Dr. Robert Strang has devised an excellent means by which space may be obtained. It can be justly called the Strang loop. Fig. 2 shows the loop in position in order to gain space for an impacted mandibular second left premolar. In order to facilitate the use of this type appliance, it is advisable first to start with a round light arch wire and bring all teeth into alignment, so as to secure bracket engagement, when the 22 by 28 edgewise arch is substituted for the round arch.

The next step is the construction of the loop:

1. Place the required 22 by 28 arch wire into the molar sheaths with the distal end on the left side extending through as far as the embrasure between the first and second molars.
2. Scratch the arch wire at the point of insertion into the molar sheaths.
3. Make a mark on the arch wire at the distal side of the bracket of the first left premolar band.

*Clinic presented at the thirty-first annual meeting of the American Society of Orthodontists, Toronto, Canada, May, 1932.

4. Remove arch wire and file flat the distal end of the left side of the arch wire.

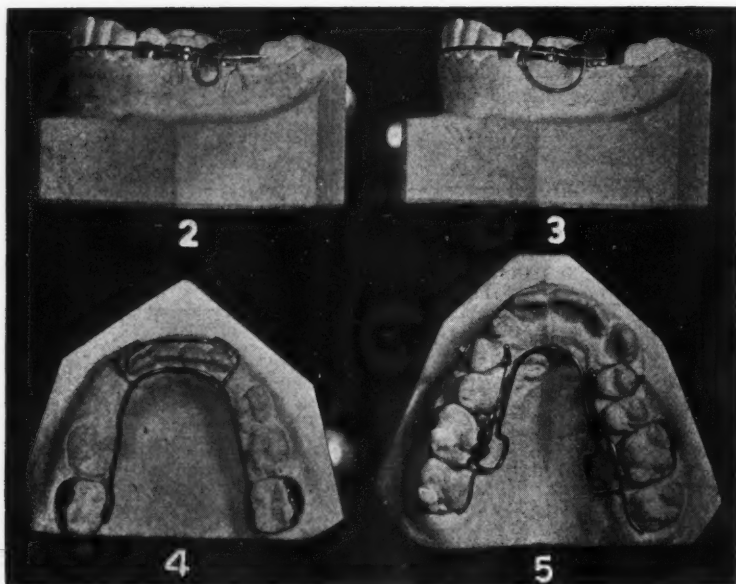
5. Solder on the distal end a small staple with the eyelet opening towards the gingival and occlusal.

6. Flatten the sides of the midjet ring in order that the staple can pass through the buccal tube freely.

7. Solder small stops at all the points scratched on the arch wire.

8. At a point one-sixteenth of an inch distal to the stop nearest the first premolar, solder a piece of 0.028 round wire. The wire should slant slightly buccally in order to avoid the gingiva.

9. Bend that wire into a loop three-sixteenths of an inch in height and let the free end cross the edgewise arch wire about one-eighth of an inch from the molar stop.



Figs. 2, 3, 4, and 5.

10. Cut the free end, file the end flat and solder to arch wire.

11. Cut the 22 by 28 arch section at the center point between the two soldered ends of the loop.

12. Place appliance in the mouth, ligate all brackets.

13. Thread a piece of 0.010 stainless steel ligature through the eyelet on the distal of the arch wire, and bring the free ends around the molar sheath and tighten.

14. This creates a force on the loop spring.

Fig. 3 shows another form of loop for opening spaces. The construction is somewhat similar to the one just described. However, there is no eyelet necessary here, instead, the spring loop is soldered to the arch wire mesially to the first premolar. The rest is identical.

During the transitional period from deciduous to permanent denture, an appliance similar to the one shown in Fig. 4 may be used. When deciduous teeth are

in place or when they have been lost and the permanent ones have not erupted, it is inadvisable to use the bracket band method, because the distance is too great from incisor bracket to the buccal tube and the arch wire is easily bent. However, in cases of the type shown in Fig. 4, i. e., the incisors are in supraversion, and the arch is in retraction and contraction; by banding the four incisors and constructing an appliance of this type, some movement may be accomplished during the transition period.

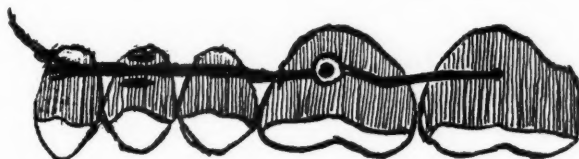


Fig. 6.

In cases where we find an extreme dental alveolar contraction, the appliance shown in Fig. 5 is extremely useful. Dr. Angle advocated the use of torque for widening arches; this, however, has not been a successful operation in my hands when width greater than 5 mm. is indicated. With the use of a lingual appliance as shown, lateral expansion of teeth bodily is positive. The only objection to this type lingual, is the fact that distal tipping of the teeth is inhibited due to the half-round post and tube for attachments. This may be overcome either with the use of the round post and ring as shown in Fig. 6 or by first using the lingual, obtaining the necessary width, and then removing the lingual appliance.

DEPARTMENT OF DENTISTRY FOR CHILDREN

PRESENTING PREVENTIVE DENTISTRY TO YOUR PATIENTS*

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THE main purpose of this paper is to explain, by the use of models as a key to understanding, preventive or control dentistry for children. The object of preventive dentistry is the stamping out of dental disease in its incipient stages by eradication of pits and fissures. Fully 90 per cent of oral disease and the train of systemic infections that follow can be prevented if proper care is given these initial defects.

The word "prevention" is used in its broadest sense, for I am aware that several interpretations are possible.

Of recent years much has been said and claimed for nutrition as the real preventive treatment, going back to diets before and during pregnancy for the mother and child. We are all mindful of the fact that the tooth is a living tissue and subject to the same nutritional changes as are other tissues and organs of the body. But it must be remembered that the human organic unit is a complex mechanism, and it is not logical to expect that any one factor can be relied upon to produce healthy growth and development or to control the disturbances that result in ill health.

While we recognize that in the near future the answer to the problem of dental disease may be found, yet we must wrestle with this situation as it exists today, for that cannot wait. And if tomorrow shows us a better method to control this condition, we shall adopt it immediately.

Statistics from whatever source you gather them will reveal the appalling need of more and better dental service. The prevalence of disease and defects among school children presents a picture and problem of justifiable anxiety and apprehension according to Dr. Detlefsen of Philadelphia in his survey of the schools of that city. He states, in effect, that it will necessitate an enormous expenditure of money and require the services of a small army of physicians and dentists if they are to prevent and eliminate the prevalence of diseases and defects existing simultaneously with this larger problem of mouth infection, tooth decay, interference with dentition and deformities of teeth and jaws.

Dr. Detlefsen classifies the child dental health problem in three divisions:

1. Pathologic.
2. Developmental; which includes retarded and difficult eruption, single and multiple impactions, temporomandibular maladjustments, imbalance and tonic disturbances of the muscles of mastication and expression, as well as all classes of malocclusion with their crowded teeth, underdeveloped jaws, and facial deformities, which make mastication imperfect or impossible.

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3. Sequelae; which include sinuses, tonsils and digestive tract. Quite on a par with the sequelae of mouth infection, are those of maldevelopment. Abnormal tooth eruption can cause infantile, adolescent and adult neuroses, strabismus or crossed eyes, convulsions, chorea, spastic manifestations epileptoid in nature, and conditions diagnosed as insanity. Deformities of the jaw can cause condylar trauma in the auditory area, tinnitus, deafness, vertigo and other reflex symptoms, and personality defects, which may lead to a severely handicapping inferiority complex.

The above statement of facts, compiled by Dr. Detlefsen, certainly puts the issue squarely before the dental profession. The question now resolves itself into, what are we going to do about it? True, we cannot all be scientists or re-

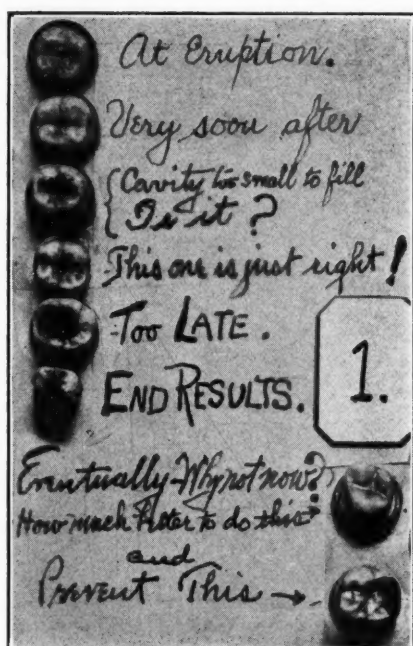


Fig. 1.

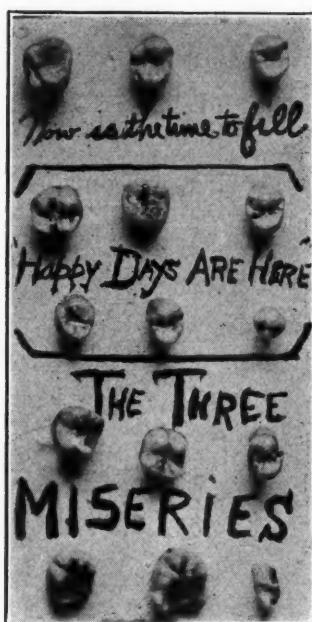


Fig. 2.

search workers, but we can all start a little educational program in our offices that will give us an opportunity, as general practitioners, to do our bit.

The use of models is the greatest aid in telling your story to patients. Dust off your laboratory shelves, pick up the scattered teeth you find, arrange them into groups and weave a story around them. Take some impressions and color the plaster models to reproduce conditions as you see them. In a week's time you can assemble a clinic of educational value that will be of great help to you. Spread the gospel and tell the truth about good dentistry; and before you realize it, you will become an enthusiast and more interested in your chosen profession than ever before.

The office bell rings. Some one has come in. Your secretary seats Mrs. Card in the chair. She has come to have her dentures adjusted. Inquiry reveals that she has two children; a neighbor told her to come to you, because you showed such unusual interest in children. She had never considered children's first teeth of

any consequence, as no one had encouraged her to have the baby teeth filled until she met this new neighbor.

Mrs. Card even quotes other dentists to the effect that baby teeth did not matter, they would soon come out and new ones would take their places, etc.

The neighbor had said something about the children's health being affected if mouth conditions were neglected, and that started a new idea with Mrs. Card. Her thoughts ran swiftly over her own past experience; edentulous at forty years of age, dependent upon suction plates when she might have retained her own teeth. These thoughts and the health talk of her neighbor opened the way to show her the new dentistry of today.

Mrs. Card is interested to know how prevalent dental disease is in children of

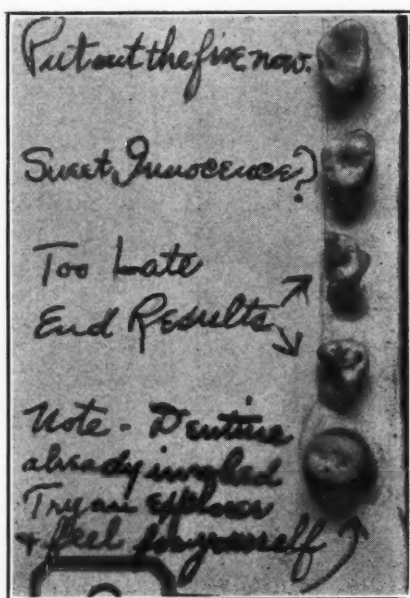


Fig. 3.

school age. Here are statistics gathered for five years, from groups of preschool children, average age five and one-half years.

316 Children examined	average age	5½ years
26 Children with perfect teeth		8.2 per cent
2790 Cavities	average	8.8 per child
348 Abscesses	average	1.1 per child
310 Erupted first molars		
183 Erupted first molars with cavities		59 per cent
25 Children needing orthodontic treatment		

The figures are dependable and the percentages will compare very closely with other localities. The check-up on the 26 children with perfect teeth showed the mothers had been very careful as to their own diet, as well as the children's, and had followed very closely the directions of their physician, and also pamphlets and literature procured from the Department of Public Health.

Most of the families of the children with the cavities and abscesses and deformed arches had paid little or no attention to diet, and the children ate what the

rest of the family had, plus penny candy between meals. The question of sugar may or may not be a nutritional problem in itself, but it does spoil the appetite for good wholesome food if eaten before meals. If sugar is given after meals, no particular harm results, according to Dr. Percy Howe.

The report of the White House Conference showed disaster at the school age of eight years. The Harvard report showed an even greater handicap in the young adults entering the university.

Mrs. Card is amazed at the prevalence of dental disease as shown in the pre-school report and decides to send her oldest son, Johnny, aged nine years to the dentist. After many appointments his case is finished. She now wants her youngest son, Freddie, aged three years, examined. His report is as follows:

1. Oral examination:

Active decay	2
Pits and fissures	7
Abscesses	0
Cleaning necessary.	

2. X-ray pictures:

Normal number of teeth present and in apparently normal stage of development.

3. Study models:

Occlusion and function good. Some signs of incipient malocclusion, slightly excessive overbite. Tendency to retrusion of mandible.

4. Physical signs:

Hair, coarse and brittle.

Color, poor.

Breast-fed child.

Height and weight: $7\frac{1}{2}$ per cent below the average.

Eyes and facial expression suggest adenoids.

Typical fatigue posture.

Muscles flabby.

Reactions slow.

Resistance to infection low; has had mumps, scarlet fever, colds, whooping cough.

Finger sucking.

Candy eater.

Compare that with his brother Johnny's case, aged nine years, recently finished.

- | | |
|--|---|
| 1. Extraction of first permanent molar and 1 deciduous molar | |
| 2. Space maintainers | 2 |
| 3. Large deep fillings | 8 |
| 4. Toothaches located | 3 |
| 5. Teeth missing | 2 |
| 6. Abscesses | 2 |
| 7. Cleaning necessary. | |
| 8. Positive malocclusion, needing orthodontic treatment. | |

An already diseased mouth requiring twelve visits in all to bring it back to a healthy state, far in excess of what Freddie's case will require to maintain its health.

Mrs. Card is impressed with the examination and happy that Freddie can escape a great deal of what Johnny went through. She had never realized the in-

formation that was available from a thorough dental examination, and particularly that the problem of physical health was so closely related to mouth conditions. For her information a set of five large plaster molar casts, showing the progress of decay, was placed before her. The first model was a normal healthy tooth, showing its histologic structure. The second tooth showed the incipient stage of decay at the junction of the enamel lobes, illustrating pit and fissure decay. The third model showed deeper inroads of decay in the dentin and the start of inflammatory

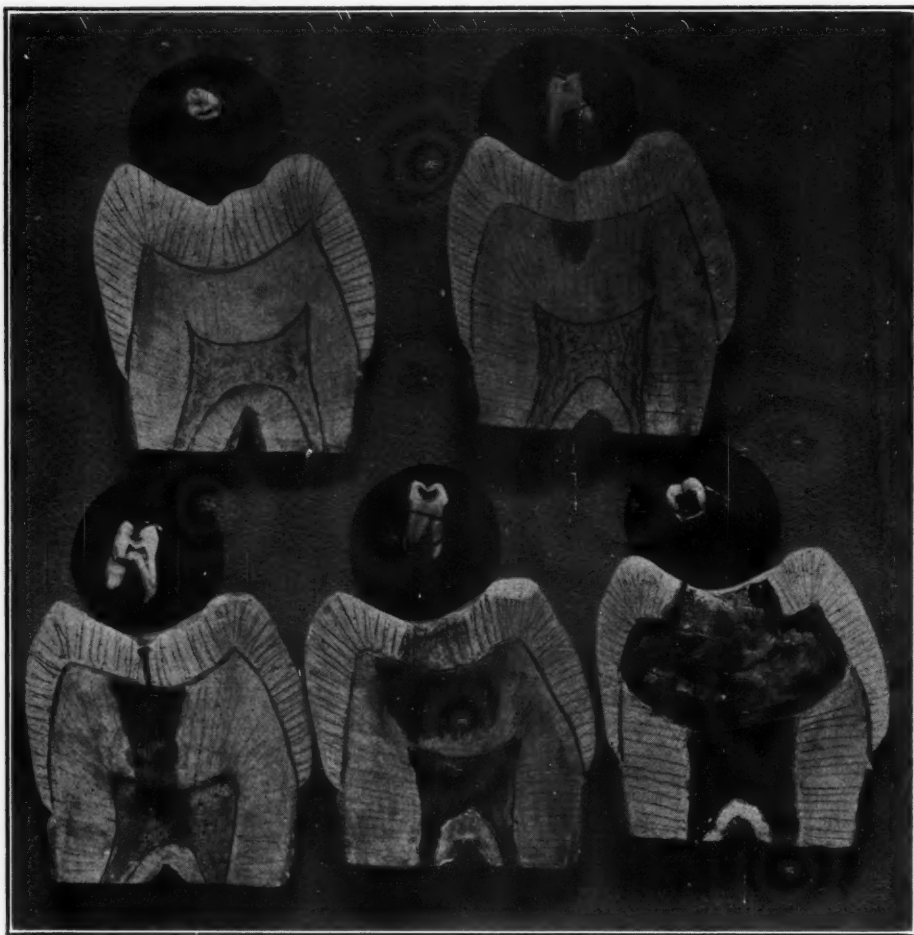


Fig. 4.

irritation of the dental pulp. The fourth, still more advanced, depicted the congestion of the pulp approaching its death, and the fifth model showed the enamel badly broken down and undermined by the spread of decay in the dentin and a gangrenous pulp, reeking with infection, a typical end-result of neglect. (Fig. 4.)

That there may be no doubt about the accuracy of these models, I have ground a set of real molar teeth showing the identical stages of decay, in exactly the same manner and mounted on individual bases. As a final proof of this whole pit and fissure problem, a set of ground sections for microscopic study are arranged over an illuminating box, where, even to the naked eye, the progress of dental disease is clearly shown.

That Mrs. Card may understand more thoroughly, the formation of the molar or premolar teeth, and especially that she may know what the dentists know about them, an ordinary cloverleaf biscuit with three parts is placed before her. (Fig. 5.)

"Now, Mrs. Card, you know that this biscuit was put together with three pieces of dough; in a similar manner the molar teeth develop from three or more centers, that grow until they each form an individual cusp and the whole group unite, just like a little biscuit. The little hills and valleys of the biscuit resemble the similar markings on the natural tooth; but, whereas you might pull the little biscuits apart, because there is a fold between each cusp, with the tooth you cannot do that; it is too hard; but the structure is much the same in both the molar tooth and the biscuit."

When you mention pits and fissures, the lay mind thinks of these folds and knows exactly what you mean, without the technical nomenclature.

How soon should you look for trouble in these pits and fissures? According to Dr. Thaddeus P. Hyatt, from figures gathered over a long period of time, of some 36,000 dental examinations, these pits and fissures, in a period of five to ten

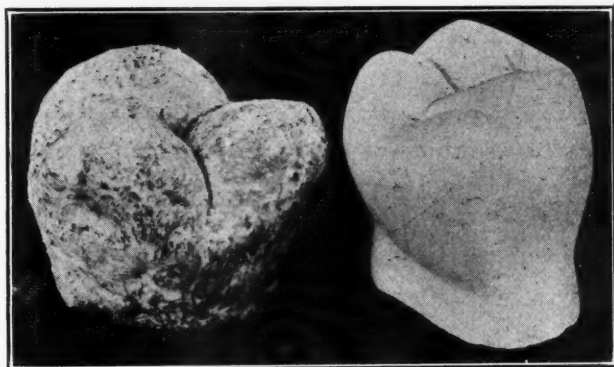


Fig. 5.

years after eruption of molars and premolars, will decay in the ratio of 2100 to 1. I pointed out in my preschool chart of 310 newly erupted first molars, that 183 had fissures that would hold an explorer securely, and clearly showed evidence of incipient caries. I am sure that in the next five to ten years, if this group could be charted, some equally startling figures would result.

Many dentists refuse to fill pit cavities because they are too small. The time to put out any fire is when it first starts. So with teeth, if you would bring a child up to manhood with a set of strong healthy teeth, the time to prevent mutilations and unsightly fillings is to stamp out the decay at the pit and fissure stage.

A large block of teeth, illustrating this statement of Dr. Hyatt's is arranged in sequence, and makes a very convincing argument in telling your story to patients. (Fig. 6.)

Make it plain to Mrs. Card that frequent prophylaxis not only is beneficial but leads to early recognition of dental decay, the proper time either to fill or to care for pits and fissures.

Explain the advantages of repeating x-ray examination each year, or oftener if advisable, not only to detect incipient caries, but also to study the growth and development of the permanent dentition.

Repeat study models each year to study function and recognize malocclusion in its early stages.

If the children are still underweight, study to find the cause. Check up on diet, elimination, sleep, rest, play, exercise, etc.

Suggest an examination for adenoids and tonsils by the child's physician.

Exercises of various sorts are valuable to restore health in correcting faulty posture, developing muscular tone, and correcting bad habits, such as mouth-breathing, etc.

Up to this moment, your interest in the case has been unusual from the dental standpoint and the patient is impressed. You have added a real health service to her idea of dental care.

It is now easy for Mrs. Card to understand the necessity for the early ap-

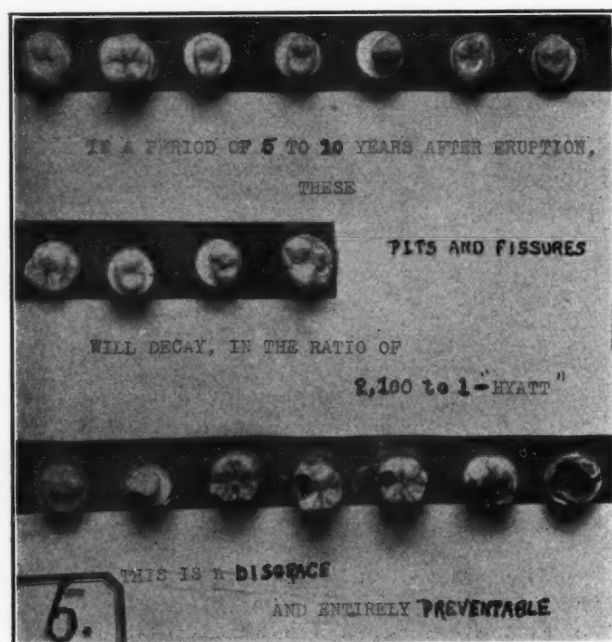


Fig. 6.

proach to the dental problem, followed by frequent and systematic appointments, according to definite schedule, clear through to maturity. The up-to-date dentist takes every known step to prevent abscesses and their dangerous end-results; his objective is health, and every procedure is based on that approach.

It is to a degree insurance against ill health from such causes. Its value does not lie in the number or size of the fillings required, but just the opposite. The fewer the fillings, the greater the local and general health.

Its full value lies in the service of constant watchfulness and the intangible items of sympathetic care, attention to habits, study of growth and development, recognition of physical and mental signs of unbalance, and the many threats against well-being.

The success of preventive dental service also depends upon complete cooperation from the home.

"My professional responsibility covers all the technical points, but, Mrs. Card,

you must remember that you also have a responsibility, which naturally rests in the home, such as attention to diet, hygiene, balancing daily activities, keeping appointments faithfully, and following all instructions given. In other words, please remember, this service is an effort to prevent or control dental disease from causing systemic disease.

"Constant care and attention are necessary because in the natural course of events, 20 baby teeth drop out before the thirteenth year and 32 big permanent ones erupt, usually by the twenty-first year.

"Decay is rapid and destructive, hard to detect in its early stages."

Mrs. Card has caught the spirit of the scheme, declaring, "If my children can avoid the dental grief that I have experienced all my life, I shall certainly believe in what you have shown me. I think your plan is wonderful, and I shall tell all my friends and neighbors about it."

It is important to remember to impress on your patients that: Dentistry for children is a health service. Success depends upon: (a) early detection and care of pits and fissures, (b) systematic and periodic attention, (c) cooperation from his home, (d) full recognition of the relation to general health. Baby teeth should be kept healthy for the sake of health. Toothaches and abscesses can be avoided. Large fillings are a big handicap. Every tooth is essential to good function. Good function is essential to good digestion. Good digestion is essential to good health. Malocclusion should be recognized early and corrected early, as an aid to function. Habits interfere with function and are best corrected before they become established. Growth and development are a slow, constantly changing process that needs supervision. The increase in height before Freddie is eighteen years of age may be 30 inches and in weight may be 130 pounds. Height and weight observations taken periodically show the rising curve of growth. Pits and fissures, neglected, may result in foci that menace the vital organs. The child's confidence can only be won by reaching the level of his understanding and interests.

The saddest part of the story is best understood when the patient is shown a group of models under the title, "Preventable End-Results." To the layman it is a ghastly exhibit; it tells a story that carries you through the dental problem, from early youth to old age, starting with a perfect tooth and then showing the various stages of decay, from pits and fissures to destruction.

Among them are groups illustrating deformities of the dental arch due to finger sucking habits; malocclusion of teeth and the effects of neglected pyorrhea, showing disturbances of the supporting tissues, much of which is preventable; models showing precancerous lesions; abscesses and the destruction of the alveolus; green stain and the resultant cervical cavities; mouth-breathing and constriction of dental arch, due to adenoid and tonsil interference; deformities due to too early extraction of deciduous teeth, and neglect of using space maintainers; Hutchinson's teeth. (Figs. 7-14.)

By the use of models, the eye can see what the ear is hearing, and your story is most convincing.

Many patients, referred to the orthodontist with the report that all dental cavities are filled, are sent back to the dentist to attend to undiscovered cavities.

The average dentist dismisses his patient as finished with sometimes 50 per cent of the necessary work untouched. The following is just one out of hundreds of

cases. A manufacturer, a newcomer in town, recently entered my office for an examination; with the aid of the x-ray examination, transillumination and a fine explorer, I marked fifteen open cavities large and small. With a blast of air, I dried each tooth in succession, he held a hand mirror and watched me, and saw the explorer drop into the cavities. He was convinced but was troubled about something and after a few minutes remarked, "Doctor, I just had my teeth all finished three



Fig. 7.



Fig. 8.

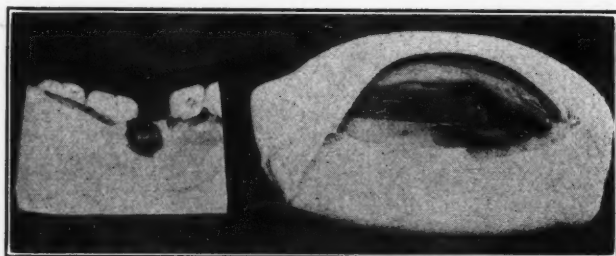


Fig. 9.—The large model represents the irritation of the lower lip by a protruding maxillary left canine.

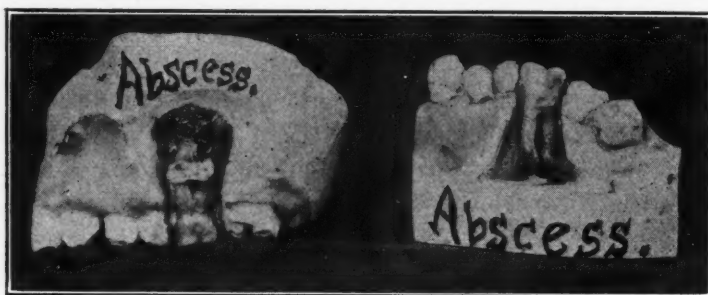


Fig. 10.

months ago." I showed him models of several teeth that illustrated exactly his problem. At this point I was anxious to get his reaction and asked him to be very frank and state his mind freely. After a moment's pause, "Well, Doctor, you want me to be frank, I shall be. In the first place had you not shown me those models and illustrated them so clearly, I should have been inclined to doubt your word, and would have gone to some one else to verify your findings. But your evi-

dent honesty and extreme thoroughness in your examination swept away all my doubts. Then as the truth of it all came to my mind so clearly, I caught some of your enthusiasm, for I realized that here was a man who really found my troubles, and that is what I came to you for, and I am thankful to you for your keen observation. My teeth mean a lot to me and I intend to save them as long as it is possible." To his question as to why this trouble was not found three months ago, I simply changed the subject. The examination ended, the patient arose from the chair,



Fig. 11.



Fig. 12.

shook hands with me and asked my secretary to make a series of appointments to take care of his work.

The old system of hit or miss methods must give way to the newer and more thorough system of examination.

Regardless of the fee determined upon according to this plan, the service for the child must be complete as outlined, else it is no greater health advantage to the child than the old type of service.

No figures of cost will be given, as each operator must determine his own, and a certain degree of flexibility is inevitable, because of the initial handicap in physical and oral condition that the child presents. The greater the handicap, the greater is the operator's responsibility. Since the financial condition of the patient is always to be considered, a lower fee can be quoted by requiring such patients to come in your less productive morning hours.

Your knowledge, skill, judgment, and time are all items of service. It is comparatively easy, after the examination is completed, to arrive at a fairly accurate estimate of the time required for all technical procedures. Because of the intangible services necessary to this approach to the problem, the charges can be equitably based on the service rendered, preferably on a yearly basis, as being eminently fair to both parties.



Fig. 13.—The right-hand model represents migration of the first permanent molar through premature loss of premolars.



Fig. 14.

If you are paid only for the time required for the chair service, you cannot afford to give your time, for the equally necessary intangible service, required for the education of the parent and patient, and the quality of your service suffers. Nor will your services be of value unless appointments are periodic and frequent.

The yearly fee can easily be arrived at by a self-analysis of the value of your service, technical and intangible, measured in terms of your experience, skill, judgment and other personal qualifications. Other items for consideration include the tractability of the child, the degree of cooperation to be expected from the home, and the handicap of age and physical and oral conditions, which are originally presented by the child. It is a method successfully practiced by orthodontists and specialists in dentistry for children.

It is also acceptable to the parent, because it definitely fixes the yearly expense.

Experience has proved that the cost to the family over a period of years will be no greater and probably will be less than caring for the child under the old procedure of charges.

There is an additional very great advantage in securing the cooperation in keeping frequent appointments, which could not be had if it was thought that an added appointment meant an added charge. Since these intangible items to a large extent do not need to be repeated each year, the first year's fee should naturally be larger than any successive one.

If the child's original handicap is a large one, in age, number of cavities, abscesses, missing teeth and the like, it can best be handled by charging for the service according to your present method, until the mouth has been put in a good healthy condition; then a yearly fee basis, can be started bearing in mind that the handicap to successful effort will follow through the successive years and will require more hours of technical attention, which would place the fee at a higher level.

Lay aside all consideration of the dollar value of this service, and measure the results in terms of health. There is no question but that this type of service not only will exercise a more complete control of oral disease, but will actually prevent a large percentage of disastrous sequelae that are responsible for involvement of vital organs that threaten life itself in later years. It is accepted that heart disease may arise from an oral focus, and government statistics show an alarming increase in this one item in both adults and children in recent years.

There is no stronger argument that can be used to induce the dental profession to adopt this procedure immediately in meeting its acknowledged responsibility for the health of the public.

No other procedure can so completely answer and avert the threat of some form of outside control of dental service for the public, such as insurance dentistry, than can the voluntary adoption of this line of action, because all such threats arise from the public's conception that the profession is not meeting its obligation to the public.

This plan makes for better health and higher resistance to infections. The child will have a happier mind, free to learn school lessons and to become physically fit.

We have heard, in recent times, much about new deals, new shuffles in politics; but let me register one thought with you now, and that is, "Let us give a square deal to the forgotten child." Remember that the child in your chair today is the grown-up patient of tomorrow. Let us also remember that it is far better to stamp out dental disease in its incipient stage than to have to repair bodies with broken health later in life.

The public's conception of dentistry is outdated, and its education to the new order of things is our responsibility. The present generation of children is growing up in our time, under our care. A new torch has been thrust into our hand, "prevention." Will we let its light flicker out through indifference, or will we struggle on to place it on a higher pinnacle where its flame will be a beacon to those who follow in the future?

THE PUBLIC CLINIC AS A MEASURE OF THE COST AND VALUE OF UNIVERSAL HEALTH SERVICE*

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WHAT I have to say in this brief paper is intended to apply more specifically to dentistry, including, of course, its specialties—orthodontia, periodontia, etc. But at the same time it is my belief that it applies just as forcefully to all other branches of medicine. There are many men who have a much wider knowledge than I of the public clinic and who could tell much more about the good it has accomplished, and in some cases the harm or disadvantage that has or might come from it. However, my knowledge of what the public clinic has done is, perhaps, equal to that of the average practitioner, and except where abuses have crept into the conduct of a clinic, I am sure it is the consensus of opinion in the profession that the public clinic has, on the whole, been of great benefit to the community at large. There are few practitioners who would need to be told what the aims of the public clinic are, and also what are its accomplishments, at least in some particular locality with which they are personally familiar, yet it is quite likely that not many of us know to what a considerable extent the public clinics in the aggregate offer and perform dental service throughout the country. I am sure it is greater than we suspect even though statistics may be available as a result of the recent investigation into the cost of medical care, and other research along these lines by persons particularly interested in the subject.

Of course, the majority of public clinics have been established under the auspices of some public institution, either hospitals of the various types or the public schools. In such cases, while the service may not be all that it should be in every instance, it is more likely that when it suffers, it is more from neglect than from perversion of the object of the service. Neither are those clinics which are not associated with some public institution, but are to be found in private hospitals or other institutions and maintained for the benefit of the impecunious, liable to any perversion of the object aimed at, because as in the public institutions, there is no money in it in any case. The only condition which I can think of in which a public clinic might be perverted so as to fail to perform the service for which it was intended, would be one which was organized under the guise of philanthropy, but actually run for profit. There may be such clinics in operation; I have heard it hinted that there are. The complaint is that those conducting them are animated solely by pecuniary motives. In other words, such a clinic may be conducted very much as an advertising office without, of course, the actual advertisements in the public prints. Patients going to such a clinic with the understanding that the fees are very much lower than in private practice can receive the benefit of those fees only if they get the same service. The little com-

*Read before the New York Society of Orthodontists, March 9, 1932.

plaint that I have heard is that in some cases the patients do not get the service for which they go, but that they get just about as much service as they can pay for in fees resembling the more moderate fees in private practice. I do not personally know of such a clinic, but excluding the possibility of abuse in clinics as just outlined, the service they are performing is such that their sudden and complete withdrawal would unquestionably work a very serious hardship on a vast number of people who have been educated to patronize them; people who could not afford fees of private practitioners, and who never received any adequate service previously to their patronizing a clinic.

Twenty-five years ago there were practically no dental clinics of any kind, except the infirmaries of dental colleges, and they were, of course, most inadequate just as they would be today, not necessarily in quality but in the volume of service which they can supply. What then was it which brought about the establishment of public clinics? Unquestionably it was the educational campaign in oral hygiene which was really inaugurated as a definite movement, so far as I know, by Doctor Ebersole, who gave much of his time and most of his strength during the last ten years of his life to this movement. It has been ably and earnestly carried on by others who were associated with him at the time or who have joined the ranks since. Undoubtedly at the inception of the oral hygiene movement, the public was uninformed as to the benefit which might be derived from rational dental service coupled with intelligent personal care of the teeth and mouth. They naturally did not manifest very much interest in a subject about which they knew little or nothing, but any one is capable of understanding the benefits referred to if the matter is properly brought to their attention.

Dental service has been offered, but like all other health service, at a price which did not appeal to the average person, or if it did appeal to him, he was not able to avail himself of it except as an emergency service. Intelligent people having means, were, of course, availing themselves of the excellent dental service available even at that time, and had been doing so for perhaps several generations previously. But the vast majority of the public regarded dental service as the extraction of teeth which were giving trouble.

Today, as a result of the educational movement by the dental profession, the situation has been greatly altered, and the two influences most responsible have been the clinics established in the public schools which reach a vast number of children, who in turn, to some extent, educate their own households, and the development of the dental hygienist. So far as I know, this is due more to the persevering efforts of Doctor Alfred C. Fones than to any one else. He undertook to show that in a school where the children had complete dental service coupled with intelligent personal mouth hygiene, which combined put their mouths in a condition of normal health, the pupils would exhibit a far greater efficiency in their studies than would those in a school where the majority of the pupils were not receiving adequate dental service, and who had not been educated to maintain, by their personal efforts, a normal mouth hygiene. It is not necessary to quote Doctor Fones' statistics—they are well known and accepted—but I might call attention to the fact that the same experiment has since been applied in numerous other localities, and always with the same gratifying rise in efficiency.

Most of you have doubtless heard or read the addresses by Mr. Willis A. Sutton, superintendent of public schools in Atlanta, Georgia. He has spoken before meetings of the American Dental Association and other dental organizations. His attitude toward the question of the health of the mouth in relation to the efficiency of the student is more advanced than that of most dentists, at least it is more radical, and his enthusiasm carried him successfully through a campaign to introduce into the schools of Atlanta, 100 per cent dental service and mouth hygiene. He showed that in one school where 30 per cent of the children had been failing, the percentage was reduced by the introduction of this service to 8 per cent, and the children's general health was proportionally improved. He also showed that they saved in one year in one school, twelve hundred school days, and as a general result of what was done in the Atlanta schools, the repeaters, that is those who take the same year over again, were enormously reduced. It is quite likely if these two factors, namely the number of school days saved and the reduction in the number of repeaters were eliminated, it would create a saving sufficient to cover most, if not all, of the cost of dental service for the whole school, when it is taken into consideration that the cost per pupil of a school year to the state or municipality is \$108.99, and naturally when a child repeats a year he is costing, in that grade, just twice as much as he should.

Not many cities have had such a thorough campaign as Atlanta, but nearly all have through more or less adequate public clinics been educating the public to the immense importance of mouth hygiene, which of course, involves not only the individual's personal care of his mouth but dental service as well. At the present time, the whole situation presents a very different aspect from that of twenty-five or thirty years ago. The dental profession, therefore, has done a great and valuable work in educating the public to the need for maintaining the health of the mouth. True, it has been done in a rather headlong manner without realizing that by solving one problem, namely the education of the public, it was creating another problem in that it had no means of providing the service which was advocated. As a matter of fact, the number of institutions has been reduced in which dentists can be trained and the number of graduates has been reduced so that we have not even kept up with the natural increase in the population, to say nothing of the enormous increase in demand for dental service which has been created by the educational campaign. The result has been that the public generally is giving the matter of supplying dental service some consideration. They have accepted our statements that all should have this service, both preventive and reparative, and they are now saying, "Very well, where is it to be had?" We all know that it is not to be had; that there is not adequate service for half, probably not more than a quarter, if that many, of the entire population.

Institutional and panel dentistry have been introduced to a greater or a less extent, and in some countries, state dentistry added to these has been tried out quite extensively. The dental profession in this country does not think much of it. I have heard men say that it was the duty of the dental profession to educate the people to a realization that panel dentistry and state dentistry, as they have been supplied, are not good dentistry and, therefore, they should not patronize it, but go only to the best trained men, which almost sounds like self-

interest, and is certainly naive when no one should know better than the dentist himself that the rank and file of the public has no money to pay for this superior service.

Would it not be better for us to look this problem in the face? The country has been confronted with a similar problem in another matter, and we speak with pride today of its solution. I refer to universal education. There has always been educational service as well as health service for those who could pay for it, but until about a hundred years ago, there was no educational service supplied to those who could not pay for it. About that time, the more progressive elements in society believed that all individuals should have at least some education—that being born free and equal did not enable an individual to win out or even to hold his own in the game of life unless he had some of the environmental advantages which were needed to enable him to compete with other individuals more fortunately born, so far as this world's goods are concerned. In other words, if he had no education, he could not compete in those pursuits where it was required. Therefore, a very little free school was provided. The results must have been convincing because from that time until the present, there has been a steady development of the free school system, passing through the stage where all might have a reasonable education, to the stage where all were required to attend the free schools if they did not go to private ones; and finally to the present stage where not merely the abstract subjects are taught but where many trades can be at least partially learned. In other words, compulsory education has been achieved. This is paid for out of the public funds, and no child who goes to the public schools nor his parents feel that they are, in any sense, accepting charity.

This development of the intellectual side of the individual has been done in the belief that he should have an opportunity to compete with others and also because it was believed that it made for better citizenship—that the best citizen was the one who had at least a reasonable education. If this be true, how much more important is the physical well-being of the individual. For, if the physical well-being is seriously hampered, the individual is not only directly handicapped as a citizen, but he is not able even to take full advantage of the educational opportunities which are offered. It seems logical to me and I believe that it is beginning to seem logical to the general public.

We have educated the public to the need for health service in our own specialty. The same thing has been going on in all branches of medicine. Is it surprising that the public is beginning to inquire very anxiously where it can get this beneficial service? My feeling is that we have about arrived at the time where the politician will see strong possibilities in this question. He may represent to his constituents that this thing which the professional man enjoys is a monopoly, and can we deny that it is a monopoly? No individual may practice or offer health service who has not conformed to certain rather long and strenuous requirements, and has passed examinations which certify to his ability. If any one else undertakes to offer any kind of health service, he is liable to severe penalties. The politician and the people will undoubtedly, sooner or later, realize that this monopoly has been granted through legislatures which award to colleges charters which give them the right to grant diplomas to those individuals complying

with the specified requirements. With this diploma as a prerequisite, the graduate, and he only, is then eligible to take an examination for a license to practice. If he successfully passes, he then joins the ranks of those who are permitted to offer their services to the public.

The medical and dental professions have steadily elevated the standards for admission to their ranks and have given fully as much attention to the ethical as to the practical side of the matter. Our ideals are of the highest, and the best element of the profession endeavors to live up to them, but we are working under a system which was inaugurated before the need for universal health service was recognized. For in the past, little if any health service was given or advocated until the patient was ill, and under those conditions, of course, the demand for service was not universal; but now that the profession first and the laity second have realized the need for prevention and hygiene as well as reparative service, something will have to be done, and I am certain that something will be done within a few years to supply them.

The people will be informed, if they are not already, that they themselves have granted the power to the various professions to practice them exclusively, and it will occur to them eventually that they can also make other regulations concerning the situation. It behooves the profession, therefore, both in its own interest and in the interest of the public generally, to have a hand in whatever changes may be brought about. That there will be changes, there can be no doubt—that they will be unwise if not guided by the conscientious effort of the best element in the profession also cannot be doubted.

Dental service and especially orthodontic service cannot be given cheaply and has been one of the difficulties in establishing dental clinics in comparison with clinics for general medicine and other special branches of medicine. Compare for instance the time required for the correction of a case of malocclusion with that required for a tonsillectomy. All the more, therefore, has it become a matter which can only be adequately taken care of by service supplied by the community or the state.

A rough estimate of the time required for dental treatment including orthodontia for the average child is fifteen hours a year. Add to this all the forms of treatment the child might require, and it will amount to probably not more than twenty-five hours a year. Now, if the child is provided with twelve hundred or more hours of service per year in the educational field; does it not seem absurd that he should not have the twenty or thirty hours required for the care of the body? Much of the plant needed for this service already exists. The elaborate school buildings and equipment which in Baltimore represent an outlay per pupil of \$377.54 can already provide such space without much further expense except some special equipment for doing practically all treatment except that for which the patient must go to the hospital or remain in bed at home.

There will be much objection to supplying free medical and dental service, but I am told there was the same objection raised to the supplying of free educational service. My feeling is, that some of the opposition that is expressed by dentists against universal free health service is based upon fear. In connection with that I wish to say that it seems to me that universal service supplied by the state would be as great a boon to the profession as it would to the laity. All men of outstanding

ability would continue to attract to themselves a clientele who would prefer to go to them rather than to the more promiscuous public clinic because they are fortunate enough to have the means to pay for the more exclusive service, so that the private practitioner would be analogous to the teacher in the private school of today, and he would be relieved of the great burden of supplying much free service that ought by rights to be paid for by the state. Those men who have ability but do not succeed well today, would be much better off if employed by the state, their incomes would be much more secure and would be even larger. The opportunity for research on the part of both the public clinic practitioner and the private practitioner would be immensely enhanced. Thus the private practitioner could with a good conscience refer those people who sought his services but could not pay the fees he felt justified in charging, to the service supplied by the state, which should be just as thorough and painstaking as his own.

It is believed by many that the teaching supplied by the public schools of today is quite equal to, and in many instances superior to, that supplied by private schools—yet, in spite of this, there is now and probably always will be a demand for the private schools just as there will be, if free health service is inaugurated, a demand for the private practitioner. The danger, of course, in establishing free health service lies in the possibility of producing a large number of ill equipped practitioners, and here again it is up to the profession to see that the large number of dentists, which will be required when and if this thing comes to pass, measure up to the standards which have already been made.

In closing, I wish to state that I am not here in the capacity of one trying to start something, I am simply calling attention to something which has already been started as a result of the educational campaign which the dental profession deliberately and very rightfully undertook, and also by the success which has attended the work of the public clinics which were themselves a product of the educational movement. I feel absolutely sure that free public health service is coming, and with it will come the advantage of being able to control or put out of business entirely the charlatan who practices on the credulity of the public. It will come whether we aid it or oppose it, and personally, I feel also, that it will be the greatest accomplishment of civilization, greater even than free education. I have said that I believed it not only would not affect adversely the private practitioner, but, on the contrary, would be a great boon to him. But even if it did put him out of business completely, I should still believe that it is not only inevitable but desirable.

OPERATIVE PROCEDURE WITH SPECIAL REFERENCE TO PEDODONTIA*

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CHILDREN'S dentistry and dental economics are the two topics that occupy the position of major importance in the dental literature of today. Only recently, one of our important publications, the *INTERNATIONAL JOURNAL OF ORTHODONTIA*, eliminated its section of oral surgery to make room for a section on children's dentistry. Any discussion of children's dentistry will inevitably embrace a consideration of economics; and, conversely, any discussion of economics must embrace both children's dentistry and preventive factors.

Whether caries has for its etiologic factors nutritional disturbances, vitamin deficiencies, or chemicoparasitic action, I believe that in combating this disease the campaign should start with the child.

The foregoing statement is not a preface to a paper on preventive dentistry, but rather a reason for serious consideration of children's dentistry. The conscientious care of the child's teeth, accompanied by an intelligent effort on the part of the operator to make the child understand the cause and effect of caries, is in itself a most important contribution to the cause of preventive dentistry.

Not infrequently, the child is the only reason that many adults listen with any serious attention to the dentist offering instructions for the care of the teeth; for it is a well known fact that some people are bored, if not irritated, by the sermon of oral hygiene as preached by a sometimes overzealous dentist. Life would be simpler if we were all super psychologists. Not so many years ago, children's deciduous teeth were neglected because they were to have another chance at teeth, and many of those who did seek dental aid for the child minimized its importance and expected minimum fees besides. This attitude on the part of the parent, plus the tedium of managing some children, is the reason that many operators either decline to take care of children or do so reluctantly. There was a time when the mother accepted, for the child, dental services which she thought were inferior to those she herself demanded, but viewpoints have changed. I have had called to my attention instances where mothers have taken their children to dentists whose services they fancied to be superior to those of the man who cared for their teeth.

Doswell Wallis, L.D.S., England, outlines the aim of modern dentistry in the following terse sentences:

- "To preserve that which is good.
- "To repair that which is defective.
- "To remove that which is diseased.
- "To replace that which is deficient."

The first strategic move on the part of the dentist is to urge the parent to bring the child at about three years of age or before. This, and subsequent visits that re-

*Read before a meeting of the Alumni Association of the Washington University School of Dentistry, February 21, 1933.

quire no operation, will win the confidence of the child; and when the time comes for a filling it should be relatively easy to manage the little patient.

The inexcusable practice of discussion, by adults in the presence of children, of unpleasant dental experiences is conducive to misleading suggestions which stimulate fear, and these fears become more developed by the time of the initial visit of the child to the dentist. This stupidity on the part of adults we observe with diminishing frequency, which we believe is an indication that some of our educational propaganda has not been in vain.

I shall not attempt to offer any formula for the management of children, or to describe any of the many applied principles of psychology that the schooled pedodontist brings into play. The subject is presented from the standpoint of a general practitioner.

ROUTINE WITH A CHILD PATIENT

Prophylaxis, as with the adult, should be the initial operation; the exception of course would be any case where the child is suffering. All cavities should be partially excavated and washed out with warm water, using a syringe. They should then be closed with temporary filling material, using either temporary stopping or any of the sedative cements. McBride¹ recommends zinc oxide worked into a thick paste in eugenol, with a small amount of silver nitrate powder incorporated. Any instructions as to the care of the teeth should be given only after the operator is getting well along with the required work. A more receptive mood develops with the realization that progress is being made. Some men talk too little, others preach themselves into unpopularity. I believe that it is a fallacy to expound unproved doctrines regarding etiology of dental caries. While we may not be convinced that hygiene in the mouth is the principal controlling factor of dental caries, it is nevertheless a most important prophylactic measure. I have in mind individuals who virtually discontinue habits of mouth hygiene because they have heard medical or dental men state that prophylaxis has little bearing on dental caries. Where this has happened in the cases of highly susceptible individuals, it has usually proved disastrous.

Hess² says it is very questionable that dental caries is a specific nutritional disorder; and, if it is, which he does not believe, he thinks that the specific cause has not yet been discovered. He has met with numerous cases of nutritional disorders which did not induce caries. T. C. Hempelmann calls attention to the many rachitic negroes, many of whom are free from caries. Hess further states that it is the general experience of physicians and laymen that carious teeth are to be found in children of the well-to-do, who have had a liberal diet, and who never suffered from rickets. He does not admit that children who have been protected from rickets develop less caries than children who have not been so protected.

Much has been written of vitamins A, C, or D that are necessary in the prophylaxis of caries, and for the normal eruption and evolution of teeth.

Abt³ points out that most of the evidence which has been offered on this point is the result of laboratory experimentation on small mammals. He believes that in order that our knowledge may be extended on this point it is obvious that the laboratory evidence should be confirmed by accurate and extensive clinical investigation and cooperation. Abt summarizes, "A review of the relationship between

pediatrics and dentistry seems to indicate that while the mutual interests of these departments of medicine have come to recognize their interdependence, many problems are still unsolved; demanding continued study, more thoughtful consideration, and further investigation. Dental disorders, like other disease processes, cannot be successfully prevented until a fuller knowledge is acquired of their cause and nature. We must await the time when the methods of prophylaxis shall be based on accurate etiologic data, obtained by rational observation and experience."

Jeans and Boyd,⁴ in their experiments on diet and its relation to dental caries, claim in their report that children, following the stipulated regimen, were under observation until caries had been completely arrested. They state that in no instance did this require more than ten weeks.

Daily allowance:

- 1 qt. milk
- 1 egg
- 1 teaspoon cod liver oil
- 1 ounce butter
- 1 orange
- 1 or more servings of succulent vegetables and of fruit, supplemented with other foods to supply adequate proteins (for well and sick).

In the case of diabetic children the amount of carbohydrates must be reduced.

It is my belief that irrefutable scientific data may be obtained only where the investigators have complete guidance over a group and covering a long period, and further that it is impossible for dentistry to carry on research in a detached manner from children's general clinics or independent of medicine and collateral sciences, and for these reasons I despair of any solution as to the cause of caries emanating from the dental profession.

There will perhaps be little occasion for conflict between physician and dentist in prescribing a diet for the child. However, it should be borne in mind by the dentist that the child may be diabetic or have chronic nephritis, heart disease, or rare metabolic disturbances. The child may be allergic with a sensitization to milk or eggs. Therefore, I believe it to be good judgment to make inquiry as to whether the child is under the care of the physician, and whether any special diet has been prescribed.

A radiodontic examination of a child patient is necessary routine. As early as six years of age radiographs may reveal factors of interference with eruption of secondary anterior teeth. Dentigerous cysts and supernumerary teeth if not removed may temporarily retard eruption or induce displacements of permanent teeth. Anomalies of number are frequent, and most certainly the operator should know whether or not there is a premolar under each deciduous molar. It is important, in some operations, to know the extent of the pulp chamber or the length of the horns; also the degree of development of second teeth, or resorption of roots of deciduous teeth, or the presence of chronic infections. Where the premolar is missing, the deciduous molar should be handled with meticulous care, keeping in mind that this tooth may be called upon to serve three or four times the ordinary allotted time.

The general practitioner must, without exception, include in the survey of the child's mouth a consideration of the arches. He must detect, if present, any malocclusion. This may be first malposition of individual teeth; maldevelopment of arch form, malrelation of dental arches, or many other possible deformities including anomalies of number, form and eruption. McCoy⁸ points out that there is a vast difference between making an actual diagnosis and realizing the necessity for such a procedure. In other words, the general practitioner must recognize any departure from normal. A differential diagnosis is unnecessary. In the management of cases, whether the need of orthodontic services is recognized in time or at all, is a responsibility that rests largely with the general practitioner.

A perusal of the literature or conversation with both pediatricians and orthodontists reveals that these men consider the dentist grossly indifferent in the care of children. One of the foremost pediatricians tells me that he will refer a child to the family dentist if he finds root fragments, chronic abscesses, and pus exuding from fistulae in the little patient's mouth. But what does the dentist do about it? Nothing! In many cases there is nothing to do but to extract these roots and abscessed teeth, and this the dentist refuses to do because he pretends to believe that their presence in the mouth is a lesser evil than the loss of space that may result from their removal. It is interesting to note that even a certain specialist in the field of orthodontia in a printed discussion, prefers to have space maintained by the presence of decayed roots with exuding fistulae. He says: "I have never observed any serious trouble from this condition. These teeth are likely to exude pus every six months. This goes from the mouth to the stomach, is acted on by the acid secretion there, and does little damage."

I believe that the more conservative dentist, as well as the pediatrician, believes that these mouths should be cleaned up and the space maintained by placing little appliances ordinarily called space retainers. These are far less complex in construction than is the average crown, or other operations that the general practitioner does daily. If he does not care to do this work, the orthodontist will gladly cooperate by making and placing retainers.

FILLING OF CAVITIES

The filling of cavities in deciduous molars can be very discouraging because of pulp mortality and fillings coming out. Where concession must be made to overcome fear, I feel that we must be less exacting in cavity preparation, even though it may mean a replacement later, at which time it may be done much better.

In proximal cavities of molars we too frequently depend upon a simple dovetailed preparation, depending upon the vertical groove in the buccal and lingual walls. This preparation does not afford the stability to the filling that may be secured by the step preparation. Sometimes the child is less restless if his aid is enlisted in holding cotton rolls in place. The lightest weight saliva tube, one that is intended for a child's mouth, should be used. The cavity should be wiped out with phenol, or silver nitrate precipitated by the reverse method. Whenever there is sufficient room, an insulation of red copper cement, medicated cement or neo capper should be placed against the axial wall. The manner in which a matrix is held must be determined for each individual case. Sometimes a strip of

thin steel 0.002 thick and 3 to 5 mm. wide, and about 4 inches long may be used. One end is doubled over or rolled.

If the cavity is a distal one, the strip is placed on the mesial side of the tooth, brought around from the lingual and through the distal with the long end extending out of the corner of the mouth and held by either the operator or the assistant. Over the extending end may be threaded a cotton roll which acts as a pad protecting the corner of the mouth. A mechanical retainer may be used in some cases, in others it is expedient to measure the circumference of the crown and slip a very thin copper band over and burnish to adaptation. The tooth is filled and the band remains in place until a subsequent visit.

If the child and parent can be relied upon to observe the necessary postoperative care, I prefer to use copper amalgam. Its slow setting property is quite a disadvantage, but, if properly heated, carefully triturated in the mortar and excess mercury expelled, I believe that it is a filling for children's teeth superior to silver alloy. No attempt need be made in the way of occlusal carvings at this visit. Sharp burs of various shapes may be used to establish correct occlusal form readily, at a subsequent visit. There have appeared in literature, frequently, articles by Willett of Peoria, in which he describes the method he prefers in restoring proximal cavities in deciduous molars. He carries out a somewhat simplified slice preparation. With a Joe Dandy disk of small diameter, he cuts a small slice buccolingually of the carious proximal surface of the deciduous molar. He then carries a narrow occlusal step preparation mesially or distally, as the case may be, for the distance beyond the cusps and horns of pulp, then grinds another channel from buccal to lingual, completely through both the buccal and the lingual walls. The remaining caries in the cavity is removed with excavators, the cavity is cleansed, disinfected, and lined with cement. From here on the usual steps in indirect inlay construction are followed. On account of the narrow occlusal tie of the inlay, it must be cast of gold that is hard enough to prevent stretching. Willett advocates the inlay because he feels that it can be more perfectly contoured and can sustain a desired contact.

In the preparation of cavities, pain may be alleviated to some extent by the application of Abbott's desensitizer, or the more recent product called pantocaine which has been called to my attention by Dr. E. P. Brady. This drug is placed in the cavity, allowed to remain for three or four minutes, followed by partial excavation, then repeating with the desensitizer. This drug is said to be effective as a topical anesthesia preceding hypodermic punctures. In my hands infiltration anesthesia for children in most cases is impracticable because of the fear the child entertains for this procedure. There seems to be an increased interest in strenuous physical activities in and out of our schools, which is productive of many fractured anterior teeth—with girls receiving their share of such injuries.

Some of these fractures are safely removed from the points of danger, and no action is needed other than a watchful waiting policy until the child is fifteen or sixteen years of age. Meantime pulp vitality tests should be made once a week for one month, and thereafter once a month until a sufficient time has elapsed to give a reasonable degree of assurance.

If the fracture is close enough that protection is indicated, a modified three-

quarter crown is made as follows: Without any grinding of the tooth a modeling compound impression in a copper band is made. This may be poured in investment, and a three-fourth crown waxed. No attempt should be made to build up the lost portion. We are simply making a protective cover. This is cast in a gold that may be spun or burnished at its mesiolabial and distolabial border, for without any grinding of the tooth there will be distortion of impression at these points. At a point on the casting which will face the horn some gold is ground away in a concavity that will allow for a thin layer of pulp capper and zinc oxide cement.

I should like especially to emphasize the importance of conservative procedure in handling cases of injury to the anterior teeth—especially the deciduous teeth. These cases sometimes present a picture of extreme laceration—teeth in what seems to be a hopelessly loose condition—or driven back into the alveolus. The manner in which many of these cases with serious injuries make a complete recovery, without any interference other than frequent washing with a soothing antiseptic, is amazing, and for this reason the operator should in most cases give nature plenty of opportunity to make a repair.

In cases where an anterior incisor, either deciduous or permanent, has been lost, I believe that two narrow platinum bands as abutments with a facing assembled is a good plan. This may not be so satisfactory from an esthetic point of view as a little denture, but most certainly it eliminates that undesirable irritation of gingival borders that accompanies most of these partial dentures. Willett, whose enthusiasm for the cause of children has carried him further afield than most of us, reports a case where a full upper and a partial lower denture are placed in the mouth of a child less than four years of age. A marked mental and physical improvement was demonstrated in a very short time.

THERAPEUTICS

Where exposed pulps are encountered, I believe it is perfectly good practice to devitalize by short period applications of arsenic or Buckley paste, followed by partial pulpectomy or complete extirpation. The tooth must be isolated by the use of cotton rolls, held in place by the assistant. The cavity is then washed and dried. If there has not been a toothache, devitalizing may be proceeded with at once by applying an arsenic disk as made by the Bird Moyer Co., or a carefully restricted application of your favorite arsenic preparation. Over this is applied a mix of cement that will run into place without packing. This is permitted to remain about twenty-four to forty-eight hours after which the chamber is carefully opened with a clean bur. The pulp tissue is removed from the chamber and from the larger canals. The chamber is then cleaned with cotton and a dry application of formocresol allowed to remain twenty-four hours. At this time neobalsam is teased into the open canal, and the additional powder added for a thick mix, which is packed into the chamber. Evangeline Jordon⁶ advocates in the place of neobalsam a paste consisting of alum, thymol, glycerin and zinc oxide.

In the case of permanent teeth having exposed horns and incompletely developed apices, I have faith in partial pulpectomy in some cases and in some pulp capping using neo capper. If the exposure is what may be called a clean one, I

prefer to wipe the area with warm alcohol, next to manipulate a putty-like mix of neo capper over the exposure. Over this I place a wall of red copper or oxyphosphate of zinc. The tooth is then filled, generally using an amalgam in posterior teeth and either cement or silicate in the anterior teeth. No pulp should ever be capped or treated by the pulpectomy method without having one of the parents called in and carefully explaining what you are doing, why you are doing it, and the possible end-results.

Pronounced hypertrophy of gingival and cervical tissue, especially in maxillary anterior regions, is a condition occasionally met with.

Hirschfeld⁷ terms this condition mouth-breathing gingivitis, and says that it is due to malocclusion and adenoids. These cases have given me much trouble. Frequent visits for removal of all deposits are necessary, and a prescribed massage by the patient, using an ointment of some description. The paste I have been using is composed of phenol, menthol, chlorotone and vaseline. This helps much, but any suggestion bearing on the treatment of these cases will be welcomed.

EXTRACTIONS

In the extraction of deciduous teeth, the general dental practitioner may gain or lose caste with his little patient by performing this work. If the tooth is just about ready for exfoliation and can be carefully manipulated from the mouth without pain, it is an opportunity to raise your batting average with the child, but do not jeopardize your standing with the patient by attempting any other type of extraction. This is, of course, a policy that is of no value to the practitioner in smaller communities.

Periodical notifications as a follow-up, I believe to be a good plan, and I have noted in several instances that when the notice is addressed to the child personally he feels a greater sense of importance and is more willing to come.

We lose adult patients frequently. Some move to other parts, others die, and still others have passed the age for dental services. We must consider the child as a source of replacement, and therein lies a very important economic factor. The child of today is the adult of tomorrow.

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TEETH AND NOURISHMENT*†

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NUTRITION exercises a very potent influence on the development and decay of the teeth. The diets of certain primitive peoples and some recent experiments on human beings show rather conclusively that dental caries can be prevented or arrested. It is, therefore, desirable that we have a better and more universal understanding of this problem.

A brief review of certain fundamentals is in order.

The teeth are a part of the skeleton; they are the only part exposed to external influences. For this reason and because the enamel arises from the epithelium, they may be classed as exoskeletal tissues.

They are also subject to the influence of the blood stream, nervous system, lymph, and the glands of internal secretion. Thus they may be classed as endoskeletal tissues. Some clinicians are inclined to view the condition of the teeth as a manifestation of the condition of other skeletal tissues.

The denture presents a variety of tissues, perhaps a greater variety than any other organ of the body. Among them we find four types of cells which deposit calcium, the osteoblasts, cementoblasts, odontoblasts, and ameloblasts. All of these and their products are subject to pathologic change.

It is well understood that calcium is essential in the development of sound teeth and, since this is the element with which the dentists are more concerned and in which they are more interested, this constituent in our diet will be discussed more fully than any other.

The enamel is the hardest substance in the body, has a higher percentage of mineral matter than any other tissue (von Bibra—95-97 per cent¹) and is looked upon by some authors² as the first and strongest barrier against caries. The ameloblasts possess unusual selective properties, the utilization of fluorine in the formation of enamel being one of them. This tissue contains more than three times as much fluorine as bone.³

A pathologic condition develops in this valuable protective covering of the crowns of the teeth of young children, if an excess of fluorine is present in the drinking water. Mottled enamel, an unsightly defect of the teeth, according to Smith, Lantz and Smith,⁴ is found only when the water is rich in fluorides (2 to 7 mg. per liter). Such conditions prevail in Colorado, New Mexico and Arizona. The potable water supply in the Rocky Mountain region is harder than that in any other section of the United States.

The dentin and cementum are derived from connective tissue and compare favorably with bone in texture and degree of calcification. They are not formed from cartilage, however, the dentin being built from a papilla, surmounted by

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†Reprinted from *The Journal of Pediatrics* 2: 70, 1933.

columnar cells (odontoblasts) and the cementum being laid down in successive irregular layers by cementoblasts on the outer surface of the dentin.

The dentin and cementum each have a separate matrix and though the two tooth substances are inseparable under normal conditions, by following a careful technic in decalcification⁵ the organic matrix of the cementum may be slipped from the organic matrix of the dentin, as a finger stall is slipped from the finger. Histologic evidence points to an impenetrable layer of calcified tissue where these two substances contact each other in life.

The enamel also is believed by most authorities to possess a matrix. The controversy on this subject is woven around its composition and permeability or its channels of circulation.

Since chemical analyses of enamel were first made authoritatively, no one has denied the existence of organic material in the enamel. Its composition, however, is not known. Judging from the microscopic appearance of the enamel, it is laid down in rod-like columns, with perhaps a sheath and some interprismatic cement-like substance holding the columns together.

Whether the organic matrix of the enamel is reticulate in form and thus, as successive amounts of enamel are laid down, it becomes the sheath of these enamel rods as well as the medium through which the interprismatic cement is laid down is a conjecture.

Many workers have proved the permeability of the outer surface of the enamel by treating it with certain chemicals, silver compounds chiefly. This may be but a self-limiting chemical reaction.

Others have forced dyes into the enamel substance through the pulp in extracted teeth, or by incorporating dyes in the food of experimental animals. Such penetration may be caused by blood pressure or by capillary or surface action.

Around this particular phase of this problem, the controversy rages as to whether tooth decay is a result of intradental circulation or the action of the salivary fluids and food débris in the mouth.

While the mouth is defined as a cavity which contains the tongue and the teeth, its topographical limitations are not described. All the structures, tissues, and secretions within the mouth function in catching and masticating the food, in partial digestion of it, and in preparing it for deglutition. (John Hunter speaks of these three functions in his early writings.) It may, therefore, be classed as an organ.

From the growth and development standpoint, the period of dentition is most active from birth to the age of twelve years and it is also most interesting at this time. Midway between these ages there should normally be fifty-two teeth in the mouth in various stages of growth, eruption, and resorption.

The normal condition is what we should seek to obtain and maintain, because the premature loss of the teeth may bring a trail of deformities and disorders, which will be difficult or impossible to correct.

The infectious diseases of the mouth are frequently found in children and are concomitant with the loss of the teeth. This is another reason why the mouth should be kept in a normal condition at all times.

It is quite generally accepted that the development of the jaws is due

primarily to the normal eruption of the teeth and their normal occlusion (in physiologic function). If dentofacial deformities or malocclusion develops as a result of the premature loss of the teeth, or bad habits, permanent physical and social handicaps may follow, which persist throughout life.

It has been estimated that as many children suffer from dentofacial deformities as do from dental caries.

There are two aspects in the destructive effect of nutrition upon the teeth, one, the nonconstructive, whereby the endogenetic processes fail to produce sound teeth because of dietary deficiencies and, two, the destructive, whereby the food itself, in intimate contact with the teeth, undergoes decomposition and produces substances that destroy the teeth. Further, the omission from the diet of certain fibrous foods and fruits, which have a cleansing action on the teeth, may be a factor in causing them to decay.

A confusion of ideas in relation to these two aspects seems to prevail among laymen and professional men who have little interest in the chemical and biologic reactions which take place.

We know that the substances we take in as food and drink can cause sickness or maintain or restore health; we know that sickness may be produced within a very few minutes or it may be the result of a mild, insidious degenerative action, extending over a long period of time, and similarly that health may be restored in a few hours or it may require years by means of the diet.

We know that body cells may cease to function or may die as a result of a dietary deficiency or, if impaired, they may regenerate or new young cells may develop following a change in diet. Odontoblasts and cementoblasts are no exception to this law.⁶

We know that the secretions of certain glands in the body influence or control calcium metabolism to a remarkable extent and that the function of these glands is in part influenced by food intake. Aub,⁷ Hess⁸ and others have pointed out the probabilities in this field.

We have evidence⁹ that teeth sometimes are undeveloped and uncalcified when they erupt and, under extreme conditions, seem almost to melt away when used in masticating food, presumably as a result of malnutrition.

We also have evidence¹⁰ that progressive dental caries can be arrested in deciduous or permanent teeth within a few weeks by a selected diet and that it can be induced as quickly by returning to the old diet.

With so many influences capable of altering the tooth structure for better or for worse from the earliest embryonic stages until the loss of the teeth occurs or until death, why should we seek a specific cause for dental caries?

The endogenous factors responsible for the destruction of the teeth, or rather the lack of construction of them, are dietary deficiencies, which, according to Klein, McCollum and Kruse¹¹ consist of calcium, phosphorus and vitamin D.

"The quality of the saliva is the important thing in determining whether teeth will decay and this is determined by the chemical composition of the blood.

"The saliva acts normally as a buffer so that acid cannot accumulate and break down the enamel of the teeth. It cannot act as a buffer unless it contains a certain amount of phosphorus. There must be a proper calcium and phosphorus

ion concentration in the saliva in contact with the enamel to prevent the disintegration of the surface molecules of that substance. No matter how much phosphorus is consumed, unless a certain amount of calcium and vitamin D are also taken in, the quantity of phosphorus taken into the blood will be insufficient."

The direct destructive action of nourishment on the teeth takes place within the mouth. Certain food substances are acidic in character, others are quite easily converted into acids by the ferments constantly present in the mouth. The foods most susceptible to fermentation are the starches and sugars, which constitute a large part of our diet. The ferments are chiefly caused by bacteria; the resultant acids may be of several types but lactic acid, presumably, is the most common acid in the mouth.

Where milk is consumed in so many forms and occasionally is sour, it is very logical to assume that *B. lacticus* is constantly present. However, there are so many organisms that will produce lactic acid (some authorities state more than 100¹²) that it matters little whether a specific type is present or not.

The chemico-parasitic theory of decay assumes that lactic acid producing organisms are constantly present in the mouth; that the enzymes secreted by them attack certain foodstuffs or organic material, chiefly carbohydrate; that the organisms find lodgment on the protected surfaces of the teeth, interdental spaces or pits and fissures, and are protected by a mucin plaque from being washed away by saliva or brushed away by fibrous foods. The acid which is generated attacks the enamel rods or the interprismatic cement substance, and may dissolve out either or both.

As cavities develop, the colony has better protection and is, therefore, less easily disturbed. Knowing that these organisms cannot live in a medium of high acid concentration which they produce, the theory is put forth that the acid is neutralized by the alkaline tooth substance and thus the destruction proceeds at a rate determined by the number of organisms present, the food supply, the advantageous conditions prevailing in the mouth.

It does not follow that lactic acid is the only acid present or that may cause disintegration of the teeth. Saccharic acid, mucic acid, and others are known to be easily produced in the mouth. No thorough investigation of this problem in dentistry has been made.

We recognize that immunity is but a combination of advantageous conditions and among them, insofar as immunity to caries is concerned, are a diet sufficiently rich in alkaline substances and a normal saliva, that is, saliva with a faintly alkaline reaction.

Other adjuncts are fibrous foods which have a cleansing action when passing over the teeth in mastication, foods which are not sticky and thus do not adhere to the teeth, and foods, such as fruits, which leave the teeth free from débris.

It does not follow that these are the only foods which should be eaten but, if they are the last at a meal, there is less danger of the destruction of the teeth by fermentation of food débris.

The rôle which the alkaline ions in foods may play in the prevention of caries is in augmenting the alkaline saliva by neutralizing the acids produced by fermented foods.

The theory that the circulation of the lymph within or through the tooth substance is the principal agency in preventing dental caries is not accepted as yet by the vast majority of the dental profession.

A study of the literature and of the experimental work done indicates that, in the constructive effect of nutrition on the teeth, the primary factor is an adequate intake of the proper foods and the secondary factor is endogenous metabolism.

We must, therefore, look to the diet as a suitable source of supply from which the tooth building cells may derive the nutrient material necessary to build sound teeth. Calcium and phosphorus occupy first place, so far as the teeth are concerned, for without an adequate, utilizable intake the teeth as well as other tissues will suffer.

The list of foods which will supply these is well known and insofar as children are concerned, they are not unpalatable. Any food idiosyncrasy can be met by substitution; refusal of certain foods because of a mental attitude can be overcome by training or discipline.

The protein content in tooth substance is relatively small, 1.3 to 5 per cent. It is found chiefly in the organic matrix of the dentin and cementum. Such analyses of teeth as have been made take no cognizance of the water content, so the actual amount of protein may be lessened considerably in a true analysis.

Fat, quoted at 0.0620 by von Bibra, is of no particular importance insofar as tooth structure is concerned. However, we must not forget that fat provides fuel for the development of energy and cell energy is as important as mass energy.

Carbohydrate, which constitutes a reasonably large volume of the child's food, as well as of the food of adults in most lands, presents a question which is debatable. The White House Conference report on Nutrition,³ Chapter on Carbohydrate Requirements, states that "a minimal amount of carbohydrate is essential for the metabolism of other foods, especially fats, in order to prevent the development of ketosis.

"The optimal amount per day for children corresponds to from 40 to 60 per cent of the caloric intake.

"The requirements of very young infants for carbohydrate are usually met entirely by sugars. After six months of age a small but increasing proportion is met by starches; after the second year and through childhood, approximately one-half of the total is supplied by sugars and the remainder by starch in the average dietary."

The debatable question is whether sugar other than that found in natural foods should be used. The dentist's experience invariably has been that where a high caloric content of the daily intake is composed of artificial sugars, the teeth disintegrate rapidly. In infancy, one of the most potent causes of dental decay is conceded to be the use of sweetened condensed milk. It is not infrequently prescribed by physicians. The label on the tin of one brand states only the directions for preparing it for infant's food, in several languages. Filipino mothers in Hawaii, following such instructions, wonder why their children do not thrive on feedings of one teaspoonful of condensed milk in eight ounces of water, six times a day.

I have known a pediatrician who not only advocated artificial sugars for children but occasionally carried all day suckers in his pocket to give his patients when making his rounds.

The dentist rarely sees the child until he has reached school age; it falls upon the obstetrician, the pediatrician, and the nurse to undertake the real preventive dentistry service in the early period of life.

The White House Conference report on Nutrition³ (p. 510) condemns the procedure of supplementing natural foods with artificial sweets.

"In developing the feeding habit, only natural foods and flavors should be used. In modifying milk for the infant with sweet sugars, which is unnecessary, we make a serious mistake. The sweet taste needs no educational effort in its behalf, and might well be left to a later period, when it will be introduced all too soon by civilized custom.

"Sugar with cereal and other solid foods is quite unnecessary. This is not because there is any evidence to prove that sweets destroy appetite, but because they interfere with the normal ability of the child to select a balanced diet for himself."

With these statements, I believe all dentists interested in the prevention of dental disease will agree.

Mineral metabolism, the *raison d'être* for this paper, is a subject of which there is still much to be learned. Upon certain phases we probably are in accord, viz., that there should be a sufficient quantity of calcium provided in the daily intake to meet the growth demands of the individual and that it should be, insofar as is possible, in an easily assimilable form.

Miles¹³ says, "When converted into a diffusible form in the blood stream calcium (a) may be deposited in the teeth and bones, where it becomes relatively fixed; (b) may be deposited in the trabeculae; (c) may pass into tissue fluids, spinal fluid, or body cells; (d) may be retained in the blood stream in control of nerve and muscular irritability; (e) may be excreted."

He further states that "excessive demands for calcium occur (1) during the last half of pregnancy, when the bones and teeth of the fetus are being formed; (2) at the termination of pregnancy with the demand for milk and a corresponding drain on the mother's calcium; (3) during childhood, when there is rapid bone growth. If a deficiency exists, incomplete calcification occurs."

Dental defects, then, may be traced to an altered calcium metabolism, to a deficiency of calcium in the diet, or to the effects of the dietary intake directly upon the teeth.

Is it not conceivable that a diet can be found that will prevent or counteract the condition described as dental caries and at the same time be palatable and acceptable to human kind?

I believe that there is sufficient evidence extant to warrant our acceptance of the nutritional factor as the most hopeful means of preventing this apparently unabatable disease.

May I present some contrasting information in support of this belief, upon which I have formed my opinion. These are the result of personal study and observation or were obtained first hand from the persons named.

Esquimaux on the Pribilof Islands living on an American diet, generous use of sweetened condensed milk on bread, rampant caries; no immune cases.

Lieut. Commander R. R. Crees, D.D.S., U. S. Navy, Chaumont. Mr. Christopher, U. S. Dept. of Fisheries, Seattle, in charge of Seal Fisheries.

Esquimaux north of the Arctic Circle, where they do not come in contact with American foods, but live chiefly on fish, meat, and berries, no sugar or carbohydrates, have no caries.

Vilhjalmur Stefansson.

Present Hawaiian population, especially oriental children with a diet of rice, sugar, soda pop, few vegetables, very few citrous fruits, practically no milk, ravages of dental caries are terrible. Many cases where deciduous teeth are so lacking in mineral elements on eruption that they are worn to the gums in a few months by relatively non-abrasive diets.

Ancient Hawaiian population, chiefly Polynesian diet, fish, native fruits, and vegetables, very little starch, acid taro, all skulls found show remarkably perfect teeth, both as to structure and functional relations.

Higher class of people in Italy, rich foods, pastes and pastries, sweets and condiments, present plenty of evidence of dental caries and diseases of the periodontium.

Laboring classes in Italy with a diet of whole grain bread, cheese, and wine, vigorous functional activity of the jaws, dental caries is rarely found.

Natives of Japan with heavy rice diet, little milk, known to be universally afflicted with dental caries; no country is making greater effort to combat it by dental methods. Similar conditions are reported in Japanese colonies in California.

Natives of Guam, diet of fish, some meat, native fruits, tortillas, whole ground corn, treated with lye, washed and baked; 83 per cent of school children show very little decay and no pulp exposures.

Ralph S. Hornung, D.D.S.

There are some differences naturally in dietary prescriptions. When based upon idiosyncrasies or upon deranged metabolic processes or an abnormal metabolic rate, there should be deviations. The physician who has informed himself in these matters should be the authority.

Barring profanity and the accompanying adjective, some one has said, "Don't let the damn, dumb dentists dabble in diet."

If they are sufficiently interested in child welfare to desire to prevent dental caries and a suitable diet will prevent it and if they are intelligent enough to understand the problem and interpret the findings, there is no reason why they should not take it up. Surely, there is more justification for a dentist to pursue this study than for an ophthalmologist, a gynecologist, or a syphilologist. It is merely a matter of intelligence and good sense.

For some time it has seemed to me that the good thought, expressed in Bunting's summary¹⁴ on the various researches carried on in this field, chiefly on animals, might well be directed now to the children themselves. Enough experimental data are available to assure us that no harm will follow the pursuit of such a plan. The application of the results of animal experimentation in dietetics to human beings invariably brings up the question, will the results be identical?

The factors of variability in dentition, growth of teeth, types of teeth, difference in form and function; the wide variations in the length of developmental periods, i.e., from infancy to puberty and from adolescence to maturity; the differences in the enzymes; may not these alter the findings, when experimental evidence is applied to man?

Are we justified in accepting the results of a specific type of research, such as bacteriologic experimentation, blood tests, roentgenographic interpretations, salivary analyses as the final determinative factor and using these data as a basis for prescribing a suitable diet for the prevention of caries?

With all of these issues before us, is it not advisable for us to turn our attention directly to the children?

Two opportunities present: (1) the private practice of interested pediatricians and (2) the groups in child caring institutions who are under a liberal form of custodial control. Such institutions should be under the direction of a medical officer, preferably a pediatrician.

The important thing in either instance is full compliance with the established regimen, the most difficult thing to control.

Mothers, during the first decade of the lives of children, have reasonably good control over them, if they can be induced to exercise it. Beyond that period, established habits and an appreciation of the value of a good diet will be the only safeguards until maturity is reached, after which we must trust to the knowledge and common sense of the individual to carry him through life with sound teeth.

In institutions, it would seem to me that a sum of money sufficient to supply the extras needed to provide the essentials in a caries prevention diet over a period of five years would be sufficient to prove or disprove the theory that a suitable diet will prevent caries. There should be no deviation from the plan during the experiment.

In conclusion, may I suggest that the study, promotion, and completion of a plan for the prevention of dental caries will be most effectively carried out by the cooperation of the family, the pediatrician, and the dentist. I bring to you not a duty but an opportunity, as a professional group, to attack this problem of the conservation of the teeth at an age when probably the greatest amount of good can be done.

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ABSTRACTS OF CURRENT LITERATURE

NUTRITION AND PEDIATRICS

By SAMUEL ADAMS COHEN, M.D., NEW YORK CITY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Diet, Nutrition and Infection. Alfred F. Hess. *Acta Paediat.* 13: 6, 1932.

In a timely and highly instructive paper, Hess makes some pertinent remarks regarding the etiology and prevention of respiratory infections in children. Hess and his associates at the Home for Hebrew Children, New York, have had an unusual opportunity to observe what relationship if any exists between the known vitamins and respiratory infection.

In repeated observations which were controlled, the author emphasizes that which he and his associates have reported previously, namely, that the anti-rachitic factor—ultraviolet irradiation, irradiated ergosterol, or cod liver oil—does not increase the immunity of infants to respiratory infections. This authority states also that in the human being, respiratory infections are not due to lack of vitamin A, and susceptibility to respiratory infection cannot be lessened by means of a diet rich in vitamin A. However, Hess points out that (without loss of systemic immunity) a lack of adequate intake of vitamin C may increase susceptibility to respiratory infection because of decreased local resistance in tissues of the respiratory tract due to vitamin C deficiency.

Among other facts the author mentions an interesting observation when he writes that infants up to the age of three months or so have a high degree of immunity to respiratory infection, indicating that age is an important factor in the susceptibility of children to respiratory infections.

Medical Aspects of Child Behavior. Esther L. Richards. *Southern M. J.* 26: 1, 1933.

Doctor Richards points out that the interest of medical science in the mental health of children and of the school child is a matter of comparatively recent origin. Whereas formerly medicine was determined to find some physical cause to account for certain peculiarities or difficulties in behavior of both adults and children, Richards states that now we have come to think of an individual who functions as a total personality composed of a mosaic of parts represented in the studies of biology, chemistry, physiology, psychology and psychobiology.

This eminent authority on child behavior, of Baltimore, Maryland, makes many pertinent remarks on the mental hygiene of the school child. According to her, the mental hygiene of the school child includes a study of the habit life of the

school period, an evolution of moods and cravings, and impulses and imaginations, and play reactions and social relationship. These factors of daily human experiences are of vital importance in preparing an individual for life, which is the official goal of education. Richards points out that the skill of the mechanical or professional artisan constitutes only about 50 per cent of his market value in any sphere—the other half is made up of temperamental characteristics, native and acquired.

In regard to our present day method of education in schoolrooms, Richards states that in spite of all that education and all that psychology have done for them there is no class of children treated so unintelligently and cruelly as the retarded. The author further states that the adult is liable to forget that the retarded child has a temperamental equipment just as any other child. Because these retarded children (whose intellects never develop beyond those of nine to twelve years) later constitute the bulk of drifting and unskilled labor and also because retarded children constitute at least 50 per cent of the material going through our juvenile courts and institutions for delinquents, Richards stresses the advantages and importance of concentrating on these very children while in schools, to the end that they may be better equipped for later life.

Another handicap of childhood is that of an inferior nervous systemic organization which expresses itself in such ways as persistent and continued bed-wetting, stammering, trembling spells, ties, and asthmatic seizures. For these individuals Richards advises generous amounts of sleep, regular meals, and avoidance of fatigue strains.

Home environment and policies of training that are unwholesome are two other considerations which tend to handicap a child. Richards states that it is rare to find a child who is well trained at home become a problem at school. On the other hand a good teacher who uses the right tactics can make much progress with a child who unfortunately is untrained at home.

This authority further points out that although a child may possess good mental health, he may have a handicap because of his temperamental or personality endowment. For example, there is one type of child—outgoing personality—who is alert, responsive, frank, ready to meet the give-and-take of daily experiences, who, if something troubles him, gets it out of his system—in talking, tears, or anger.

On the other hand there is another type of child who is also quite familiar to all of us. This type is the shy, sensitive, stand-offish personality with whom, as Richards states, it is hard to be en rapport. Such a child sulks and broods and also shrinks from struggle and competition. Moreover, a child of these temperamental traits finds life progressively harder year by year. This type of child, sometimes referred to as an in-growing child, is all too frequently disciplined and also too readily classified by the teacher as a problem child. For this type of child and other such children Richards makes a plea that the child should be studied for the purpose of trying to find out of what condition the behavior is symptomatic.

The unreasonableness and unintelligence of our present day classroom methods of treating these children with parental, school, disciplinary class, misdemeanor marks and other such makeshifts, are very well brought out by Richards

when she states that "we readily condemn a physician who quiets pain with a hypodermic without trying to get at the cause of the pain, yet education gives the same palliative treatment with perfect complacency."

Diabetic Children. Elliott P. Joslin. *Southern M. J.* 26: 1, 1933.

The marked progress which has been made in the treatment of diabetes in children is vividly told by Joslin in an address before the Section on Pediatrics, Southern Medical Association, Birmingham, Alabama, in November, 1932. This outstanding authority, who has contributed much to this progress, tells of some of his rich experiences with diabetes at the New England Deaconess Hospital, Boston.

Joslin states that not only is diabetic coma in children preventable, but when coma does occur, it can be treated successfully in practically 100 per cent of the cases.

Although in his particular series of diabetic children, the incidence of tuberculosis and also of epilepsy was found to be higher than in school children of similar age in Massachusetts. Joslin's mature judgment leads him to state that normal growth, both physical and mental, is characteristic of the diabetic child. This clinician further noted that the precocious development of bones and teeth has not continued after the onset of diabetes, "although," he continues, "the excellence of the teeth of a diabetic child is now universally recognized."

In regard to etiology, Joslin again emphasizes the factor of heredity—39 per cent in his group of 553 children; for Jewish children the heredity factor was found to be as high as 44 per cent. Joslin states that the heredity goes down through the males rather than the females, possibly because every other pregnancy in a diabetic woman results in a stillborn infant.

The treatment of diabetes in children may be summed up in three words: diet, exercise and insulin. It must be remembered that only by taking the child into one's confidence is it possible for the child to learn how to adjust its particular diet and also its exercise. In his series of cases the author's average dose of insulin for twenty-four hours was 20 to 29 units. During infections Joslin stresses the fact that the dosage must be markedly increased.

Surgeons will take comfort in Joslin's statement that "surgery in diabetic children differs little from that in nondiabetics." As a matter of fact, he reports that among 88 operations, including some serious major operations, there has been no fatality.

THE FORUM

November 15, 1932.

Dr. Albert H. Ketcham,
Denver, Colo.

Dear Dr. Ketcham:

I have had some cases in which there was a separation between the maxillary central incisors and a seemingly large frenum. The question of advising surgical removal of this frenum has caused me much concern. Opinions seem to differ regarding the advisability of its removal. I am taking the liberty of writing to you and am going to write to several other men whom I consider authorities, and ask their opinions regarding this question. You have been in the practice of orthodontia for a sufficient length of time to watch the results of cases and to know the outcome of certain procedures.

I shall consider it a great favor if you will write me your views regarding the above mentioned frenum operation. Do you advise the removal of any maxillary frenums? Have you ever had any frenums removed, and if so were you pleased with the results?

Assuring you of my appreciation of your reply, I am,

Very truly yours,

(Signed) WINSTON P. CAINE,
Chattanooga, Tenn.

November 28, 1932.

Dear Dr. Caine:

I shall endeavor to express my views in regard to the frenum operation. Years ago I followed the common practice of advising an operation upon the abnormal attachment of the frenum labium, whenever upon pulling the upper lip from side to side the fibers of the frenum were found to be attached between the separated central incisors. Early experience showed that it is the better procedure first to move the central incisors together, then to remove the appliance permitting them to separate for an hour or so before performing the operation. It was found that the incisors moved together more readily before scar tissue had formed, and that, if the operation was deferred until after the central incisors had been brought together, the scar tissue would help to retain them. I developed an electric cautery for the frenum operation, having a much shorter platinum electrode than the eye cautery which we formerly used. This can be guided as accurately as a pen.

In treating the younger patients who have widely separated central incisors

and abnormal attachment of the frenum labium, by drawing the central incisors together, guiding the lateral incisors into place, and retaining them until the eruption of the canines, I have found that in the majority of cases the central incisors remained in contact after the retainer was removed, thus obviating the necessity for an operation upon the frenum. We have followed this practice for years, only operating in those cases in which the central incisors again separate after the removal of the retainer, and those rare cases where the abnormal attachment of the frenum is very pronounced or where it is so low that it interferes with proper tooth brush excursions over the labial surfaces of the incisors.

In cases of wide separation of the deciduous central incisors we advise against immediate surgical interference, for in those operated cases which we have observed the positions of the permanent central incisors, as shown by the radiograph, were not improved when they erupted.

From the above you will see that I do not consider an operation upon the frenum labium necessary in the majority of cases, but that there are cases in which the operation is necessary and of great value to the patient. Of course, sometimes we have relapses after the operation.

If you have access to a library containing Vol. I, No. 1, of the *American Orthodontist*, published in 1907, you will find an article which I wrote, entitled "The Frenum Labium and Its Relation to the Intermaxillary Suture." If I have not answered your question fully, I shall be glad to have you write me again.

With kindest regards,

(Signed) ALBERT H. KETCHAM,
Denver, Colo.

February 8, 1933.

My dear Dr. Caine:

I am replying to your inquiry regarding the removal of the frenum.

It would be interesting to know who first performed this operation and how long ago it was done. It was probably a great many years ago. It has long been in the literature, and is probably followed very largely for the reason that the profession generally is quite likely to accept a thing because it is in print (without thought as to the wisdom of a procedure) and it is willing to trust the judgment of some one else rather than the individual's own reasoning.

I have had forty-four years' experience in dentistry. For nineteen years I practiced general dentistry. For twenty-five years I have been in the exclusive practice of orthodontia, and during this time I have treated more than three thousand cases of orthodontia and have about as many more under observation. Throughout my whole forty-four years' experience I have never found a separation between the maxillary anterior teeth that I had any difficulty in closing and in keeping closed, with the exception of the type case in which there are spaces between all of the anterior teeth, both maxillary and mandibular, in which the frenum could not possibly be a factor.

Another thought that has occurred to me is this: how do men who remove the frenum in very young patients know that the space would not close if let alone. I

have had a few cases, perhaps two or three, in which some one had removed the frenum, and these are the only cases I have had trouble with in closing a space.

However, the fact that, with the number of cases I have treated and seen, I have never found it necessary to remove a single frenum is not conclusive proof that there may not, at times, be cases in which it may be necessary to do so.

With kindest regards, I remain,

Sincerely yours,

(Signed) JOHN V. MERSHON,
Philadelphia, Pa.

September 24, 1932.

My dear Dr. Caine:

I suppose there may be and are a few cases where it is advisable to clip the frenum, but (I have not seen one in my practice for fifteen years.) The idea which we had years ago that the space so common between the maxillary incisors in the young child was due to an abnormal frenum is now quite generally admitted to be a fallacy. (The space between the incisors is, in most instances, a perfectly normal condition, and if not associated with other evidence of malocclusion will usually disappear during the completion of the permanent denture.) In my opinion, it is a very rare case indeed that will justify the removal of a frenum by use of a cautery; in fact, I would not think of doing such a thing. This method of procedure which was so popular back in 1910 and 1912, caused a great deal of trouble by the creation of scar tissue where the successful treatment depended upon normal structure. Most of the men I know, no longer consider an abnormal frenum as a cause of malocclusion.

Yours sincerely,

(Signed) A. LEROY JOHNSON,
New York, N. Y.

September 28, 1932.

Dear Doctor Caine:

In regard to the removal of the frenum labium, in cases which present a spacing between the maxillary central incisors, I am pleased to state that in my twenty years' experience, I have never had but one such operation and was sorry of that one.

If you will consult the older members of our profession, I feel quite sure that you will find this practice has long since been deemed not only unnecessary but detrimental.

Trusting that the above answers your inquiry in full, I beg to remain,

Yours very sincerely,

(Signed) C. C. HOWARD,
Atlanta, Ga.

September 26, 1932.

Dear Doctor Caine:

In reply to your letter I would advise the removal of all abnormal maxillary frenums. I certainly would not remove a frenum unless it was abnormal.

I have been unable to get satisfactory results in cases of abnormal frenums without their removal.

With best wishes, I remain,

Sincerely yours,
(Signed) M. DEWEY,
New York, N. Y.

December 1, 1932.

My dear Dr. Caine:

The frenum operation you inquire about in your letter presented a problem which bothered me for a number of years.

The almost invariable removal by cautery was advocated some twenty or more years ago by the Angle School, and I could not see its advisability, particularly as the cautery left a cicatrix which was almost as detrimental as the frenum itself.

I found very good success in many cases by the lateral expansion of the arches between the central incisors, moving central incisors far apart and then working the crowns together. This worked very well in a large number of cases. In time, however, I found that many of the cases did not require any particular attention in regard to the frenum. There were, however, certain cases which did need operation. They are the frenum cases where the attachment is noticeable between the central incisors and passes up on to the lingual surface. These can be noted by pulling the lip forward and upward and watching between the central incisors and the lingual surface. If you notice movement there, you may be quite certain that the operation is advisable. To check this, I found that almost invariably the cases that required operation were those in which the frenum condition was a family trait; and, if you will inquire in these cases for similar separation in the family or in the grandparents, you may be fairly certain that the operation will be advisable.

The operation that we have found successful is that of surgical removal, but this should be done by an exceedingly careful operator in order that none of the bone is removed. I had one patient who had serious results following operation, and the central incisors were loose for a year and a half. The results after a very careful operation and satisfactory orthodontic treatment are usually quite satisfactory.

To sum up my conclusion, let me state that I do not advise the cautery for removal nor do I advise operation for all supposedly abnormal frenums. We only advise the removal of those with strong or definite attachment between the central incisors and particularly passing over to the lingual surface of the palate.

I trust my answer will be satisfactory, and if I can be of any further service to you, I shall be glad of the opportunity.

Fraternally yours,

(Signed) VARNEY E. BARNES,
Cleveland, Ohio.

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EDITORIALS

The New Deal

THE Executive Council, acting under authority of the New Constitution adopted last year at Toronto, has postponed the annual meeting of the American Society of Orthodontists, scheduled for April 19, 20, 21. An early announcement will be made as to the new date selected.

The present economic conditions present problems that are difficult to meet. It is the belief that an improved financial outlook, together with an apparent return of a feeling of confidence, will greatly tend to restore business and will result in an increased attendance at a later date, and all concerned will profit thereby.

Individually and collectively, the members of our Society will cooperate

and carry on. Our profession will progress in knowledge, in scientific endeavor and as a material aid in the correction of some of the ills of mankind in exactly the same ratio to the effort we make to learn and to serve. Adequate financial return is a simple matter in fair weather, plentiful times. It is the "rest periods of Valley Forge" that offer the real tests.

The American Society of Orthodontists has been and will continue to be the greatest single factor in the progress being made in the practice of orthodontia. Postponement may give rise to the thought that the Society is not able to carry on regardless of any condition. The officers of the Society are mindful of the fact that each annual meeting entails considerable expense and that a small attendance would not be a fair return to the entire membership. Even though the published proceedings would be available to all members, it is, nevertheless, a well known fact that attendance offers a chance to renew friendships and that the informal discussions of our problems tend to promote greater cooperation in study and in service, the value of which can only be estimated.

It has often been stated that the primary urge to practice orthodontia has often been born of the thought of a greater financial return for one's efforts. Present conditions offer an excellent opportunity to disprove such statements. The postponement can be likened to the recent bank moratorium. It gives our Society and individually each member a little extra time to take stock, to plan and to resolve to attend the meeting at the later date.

The local arrangement plans and the program are complete in detail, and considerable expense can be saved the Society if this program can be held intact. With each essayist, discussor, and clinician being resolved to carry on, a greater, a better and a very profitable meeting will be presented.

May our Society, through each member's efforts, show that we are equal to any emergency, and by prompt payment of dues, make it possible for our officers to carry on, confidently knowing that every one desires to do his part toward assisting the return of better times, a new day and a new deal. *P. G. S.*

Dr. W. R. Dinham's Clinic Plan

TWO OF the basic recommendations made by the Committee on the Cost of Medical Care are (1) that medical care be furnished largely by organized groups of physicians, dentists, nurses, pharmacists and other associated personnel, centered around a hospital, and rendering home, office and hospital care, and (2) that all basic public health services be extended until they are available to the entire population according to its needs. These two basic principles set forth by the Committee have attracted no small amount of attention everywhere, and have focused the spotlight of interest on the public health problem; also attention is called to a problem as related to orthodontia and its practice. There is probably no branch in the healing art which has a more difficult and unwieldy problem in offering its benefits and services to the public at large in an efficient and scientific manner than has orthodontia. The work requires well trained, skillful, efficient and experienced operators; it also involves the element of time, consuming all the way from a few months to several years.

The problem of supplying efficient orthodontic service at a very low cost is a unique and difficult one to solve, and this problem is attracting a great deal of attention, the inspiration for which obviously is the report of the Committee on the Cost of Medical Care. There have been some few sporadic attempts to provide orthodontic service for wider brackets of people in various parts of the country, and in this issue of *THE INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN* appears a report of the clinic plan as applied to orthodontia by Dr. W. R. Dinham of Seattle, Washington. His report is interesting, and between the lines it can be discerned that there are difficulties of no small proportion in the practical and satisfactory working out of the orthodontic clinic idea, depending solely upon self-support and without endowment of any kind. Dr. Dinham's report is of interest to orthodontists in view of the contemporaneous spotlight being directed upon the specialty at this time which exposes in the full glare the outline of a professional service of outstanding merit for children which is circumscribed and throttled, in its extension to more children of the commonwealth, because of a dearth of trained men and because of its unwieldy, cumbersome character of application.

It is obvious, judging from dental surveys of the children in the public schools, that the amount of malocclusion being corrected by trained operators is practically negligible at the present time. Here is a problem of great magnitude for even partial solution, and not unlike all other departments of professional service, it should be approached from within the ranks of the specialty itself rather than from without.

H. C. P.

The American Board of Orthodontia. Is It Justified?

DURING the twenty-eighth annual meeting of the American Society of Orthodontists, held at Estes Park, Colorado, in July of 1929, a movement was inaugurated which many thoughtful orthodontists felt was destined to prove of signal benefit to orthodontia. For a period of years preceding this action it had become apparent to many public spirited practitioners and to a considerable number interested in the field of dental education that in all too many instances those in the practice of orthodontia had entered it under varying and, sometimes, insufficient qualifications for practice. As the years have gone by, many such practitioners have also come to a fuller appreciation of what is entailed in the orthodontic problem and have concurred in feeling that a higher order of training should be required for orthodontic practice.

This conviction took definite form in the action of a group of outstanding practitioners who felt the goal desired would be more promptly achieved through the establishment of some body, or commission, the purpose of which would be to designate the minimum standards and other qualifications which should be met if a man or woman is to proclaim himself or herself an orthodontist. Their feelings in the matter were endorsed, at the time and place already mentioned, and the American Board of Orthodontia was sanctioned and sponsored by the American Society of Orthodontists.

Not so many years ago the medical profession, or at least that part of it

vitally interested in the fields of otolaryngology and ophthalmology, became impressed with the fact that many ill trained and poorly qualified men were attempting to enter these fields, much to their discredit, and the realization of this fact led to the formation of the American Boards of Otolaryngology and Ophthalmology. These organizations have no legal status as licensing boards, but their moral prestige is such that Class A hospitals allow only such men upon their staffs (in the specialties represented), who have been certified by these Boards as qualified for practice. The benefit to the public who depends upon such men for professional care has been immeasurable.

Whenever idealistic movements are started, there are always those who are skeptical of their success. The American Board of Orthodontia has been no exception to this rule, for, at the time of its beginning, many were frank to prophesy that the specialty of orthodontia was not yet ripe for such a standardizing body. Their pessimistic assertions, however, soon lost weight, for there was an almost immediate response on the part of outstanding orthodontists from various parts of the United States and Canada who were quick to appreciate the value of and the need for such a body. In fact, the first applications for certification by the Board came from men of such prominence that the success of the movement was assured. Since that time, many younger and less widely known practitioners have filed applications, and many have followed these up by complying fully with the requirements for the Board certificate.

It is having the effects of stimulating practitioners to marshal their knowledge of methods and practice in logical, orderly form, and to add such accomplishments as may be necessary in order to utilize them in gaining a certificate from the Board. It is also stimulating those who have fulfilled the requirements to keep on attaining and thereby justify the Board's confidence. In addition, the discipline of preparation is proving helpful to those striving toward the objective of a certificate, and, in most instances, the work they are doing is proving the equivalent of a graduate course in orthodontia. The possession of a certificate has become a source of pride to those who have been so rewarded, and its value is increasing year by year.

There has never been a time when a movement more richly deserved the support of all those interested in the present and future welfare of orthodontia than now. Things are moving rapidly. Misleading propaganda, backed by commercial interests, have had their effect, but "clicks" and orthodontic "sects" have no place within the profession and must give way to the nonsectarian qualified practitioner. The time when any dentist may, overnight, announce himself as an orthodontist, if he so chooses, must cease. The day of "the dabbler" is fast waning. The better element in the dental profession has his number and resents his presence. It takes a man or woman of real ability and recognized professional attainment to enjoy the privilege of displaying upon the office wall the certificate of the American Board of Orthodontia. The public will soon recognize its worth. It is hoped that those who can qualify and who have held back largely through procrastination will, at the earliest possible time, make application to the Board. This will add strength at a time in the history of our specialty when, to use the language of the Good Book, "it is essential to separate the sheep from the goats."

J. D. Mc.

NEWS AND NOTES

Eastern Association of Graduates of the Angle School of Orthodontia

The annual meeting of the Eastern Association of Graduates of the Angle School of Orthodontia has been postponed on account of existing economic conditions, from May 1 and 2 until a later date, due notice of which will be given.

WILLIAM H. PEARSON, President,
FREDERIC T. MURLLESS, JR., Secretary.

American Society of Oral Surgeons and Exodontists

The fifteenth annual meeting of the American Society of Oral Surgeons and Exodontists will be held in the Stevens Hotel, Chicago, August 4 and 5.

A. L. FREW, President,
4105 Live Oak Street,
Dallas, Texas.
HARRY BEAR, Secretary,
410 Professional Building,
Richmond, Va.

American Dental Assistants Association

The Stevens Hotel has been designated as headquarters for the ninth annual meeting of the American Dental Assistants Association which will be held in Chicago, August 7 to 12. For further information address

RUTH M. CLARK, General Secretary,
Suite 1-4, Scofield Building,
Minot, N. D.

The European Orthodontological Society

The date of the annual meeting, which was to have been June 2 and 3, has been changed to Friday and Saturday, May 26 and 27. The meeting will be held at the Majestic Hotel in Paris.

This will enable members to attend the annual meeting of the British Dental Association on Friday, June 2, at Leicester, England.

The Société Française d'Orthopédie Dento-Faciale will hold its meeting at the conclusion of the European Society's meeting.

G. F. CALE-MATTHEWS,
95 Newhall Street,
Birmingham, England.

Dental Society of the State of New York—Preliminary Program

The Dental Society of the State of New York will hold its sixty-fifth annual meeting in Syracuse, New York, May 11, 12 and 13, 1933. Literary exercises, exhibits, etc., will be held at the Hotel Syracuse. Harvey J. Burkhart, 800 E. Main St., Rochester, N. Y., is chairman of the Program Committee; Emory Thompson, 333 Linwood Ave., Buffalo, N. Y., chairman of the Clinic Committee, and Thomas R. Cullen, Oswego, N. Y., is chairman of the Exhibits Committee. The Executive Council will convene for the transaction of the business of the Society Wednesday, May 10, at 8 P.M.

The essayists are: I. Lester Furnas, Cleveland, Ohio; John Scholten and Harry E. Hanson of Cedar Rapids, Iowa; P. G. Puterbaugh, Chicago, Ill.; Walter Chappelle, Buffalo, N. Y.; Arthur B. Gabel, Philadelphia, Pa.; James E. Aiguier, Philadelphia, Pa., and Chalmers J. Lyons of Ann Arbor, Mich.

During the time of the meeting, sessions of the New York State Dental Hygienists' Association and the Dental Assistants' Association will be held.

Headquarters will be at the Hotel Syracuse, and reservations should be made direct with the hotel management.

For information with reference to the literary exercises, clinics, etc., apply to:

A. P. BURKHART, Secretary,
57 E. Genesee St.,
Auburn, N. Y.

Illinois State Dental Society

The sixty-ninth annual meeting of the Illinois State Dental Society will be held at Peoria, Ill., May 9, 10, 11.

A. B. PATTERSON, President,
406 Morris Building,
Joliet, Illinois.
BEN H. SHERRARD, Secretary,
300 Rock Island Bank Building,
Rock Island, Illinois.

North Carolina Dental Society

The fifty-ninth annual meeting of the North Carolina Dental Society will be held at the University of North Carolina, Chapel Hill, June 6, 7, and 8. All members of the American Dental Association are cordially invited.

D. L. PRIDGEN, Secretary-Treasurer,
Fayetteville, N. C.

Cleveland Physiotherapy Society

The Cleveland Physiotherapy Society was organized February 23, 1933. A group of Cleveland dental physiotherapists met at Hotel Allerton for the purpose of organizing a society for the general advancement of dental physiotherapy.

A study will be made of all appliances and wave-lengths, together with their actions and effects, through the medium of papers, lectures and demonstrations.

Regular meetings will be held on the third Tuesday of each month.

Dr. A. L. Parsons was elected president; Dr. Samuel Hollander, vice-president; Dr. Idella E. Graves, secretary; and Dr. Walter A. Loope, treasurer.

Thirty-Second Annual Meeting of the American Society of Orthodontists

The Thirty-Second Annual Meeting of the American Society of Orthodontists has been postponed until November 8, 9, 10, 1933, and will be held in the Biltmore Hotel, Oklahoma City, Oklahoma. The program as published in the March issue of this Journal will be presented.

We regret that postponement was necessary. We trust that each member and all others interested in orthodontia will keep the above mentioned dates and program in mind.

W. E. FLESHER, President,

CLAUDE R. WOOD, Secretary.

Chicago Centennial Dental Congress

The Chicago Centennial Dental Congress, in conjunction with which the Diamond Jubilee of the American Dental Association will be held, will convene at the Stevens Hotel, August 7 to 12, inclusive.

Item of Interest

Dr. Harry R. Faulkner, formerly of Greeley, Colorado, announces his location, 803 Medio Dental Building, San Diego, California. Practice limited to orthodontia.